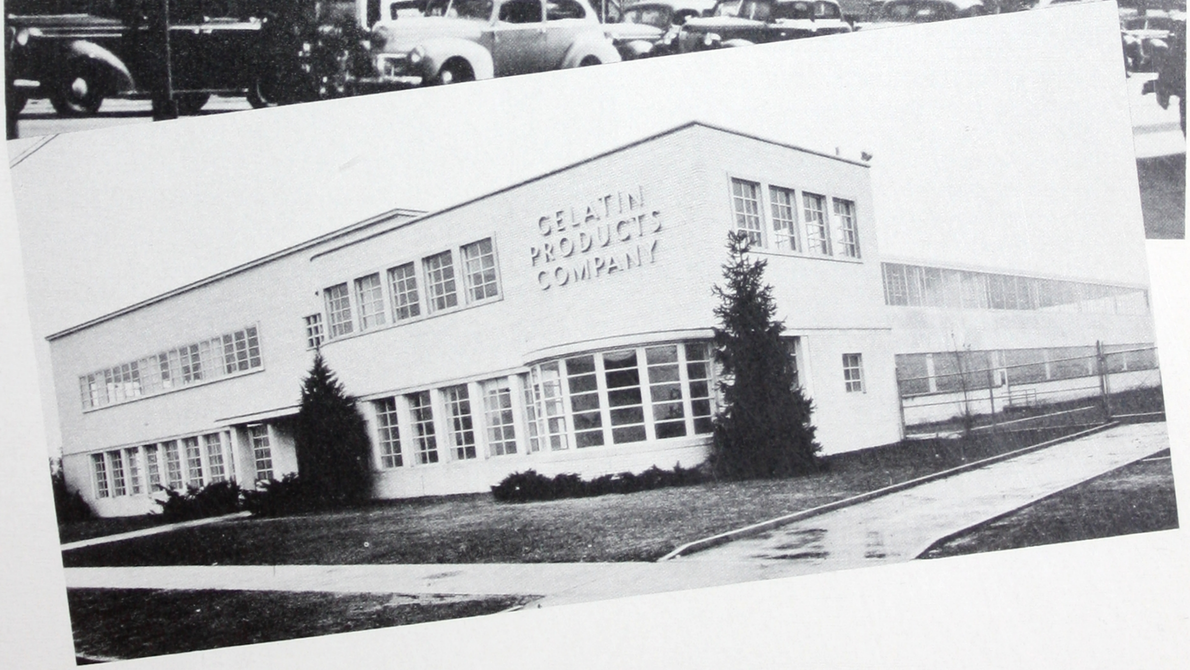
KATHABAR

A NEW STANDARD IN AIR CONDITIONING

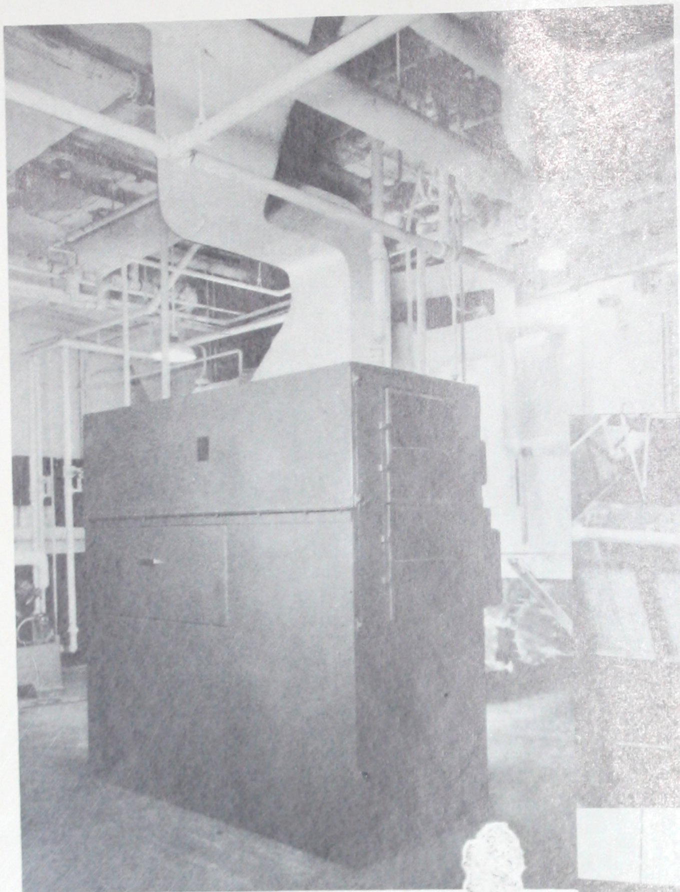
SURFACE COMBUSTION
TOLEDO, OHIO

KATHABAR FOR COMFORT and INDUSTRIAL PROCESSING



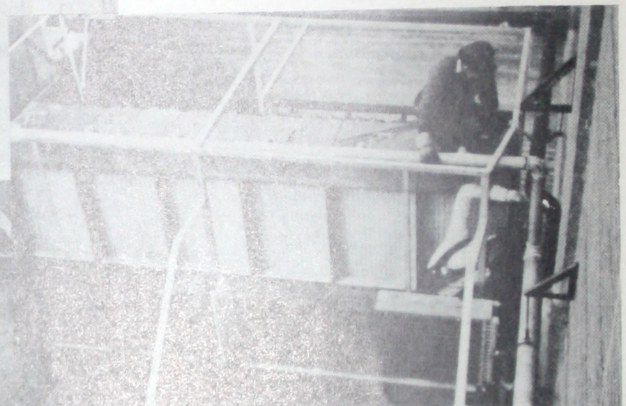
COMFORT—KATHABAR by its simple inherent control of both humidity and temperature has established new high standards in air conditioning. De luxe installations appreciate KATHABAR advantages.

INDUSTRIAL—Many industrial processes are dependent on reliable and accurate control over humidity and temperature conditions. KATHABAR installations are satisfactorily meeting the most exacting industrial requirements.

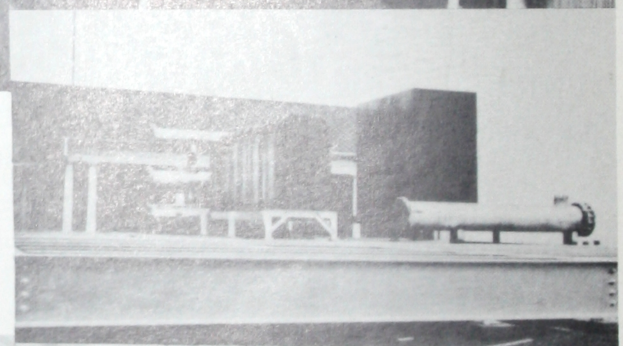


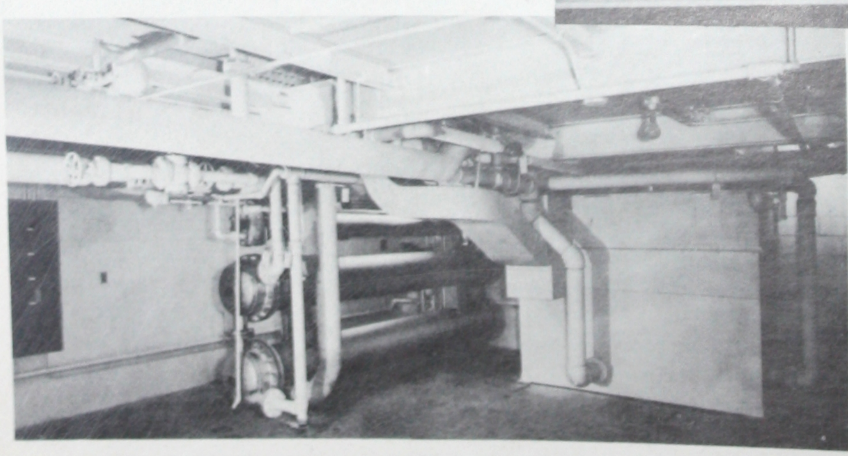
SIMPLICITY—A simple low pressure liquid circuit with a single pump, comprises the KATHABAR System. This simplicity explains why this restaurant installation operates entirely satisfactorily without an operating engineer.

FLEXIBILITY—KATHABAR equipment is now available in standard units for most any capacity up to over 100,000 c.f.m. The 30,000 c.f.m. installation for Office Building below assembled from standard KATHABAR units shows KATHABAR flexibility.



LOW MAINTENANCE—The use of few moving parts, sturdy construction, and a non-volatile liquid operating at low pressure insures low maintenance. The KATHABAR equipment shown at right being erected on top of large building gives some indication of the sturdy construction which is responsible for the low maintenance with this system.





RELIABILITY—A shutdown of the air-conditioning equipment in some industrial plants would mean losses amounting to several thousands of dollars per day. The reliability of KATHABAR equipment justifies such installations as the large one at the left serving a complete plant manufacturing gelatin products.

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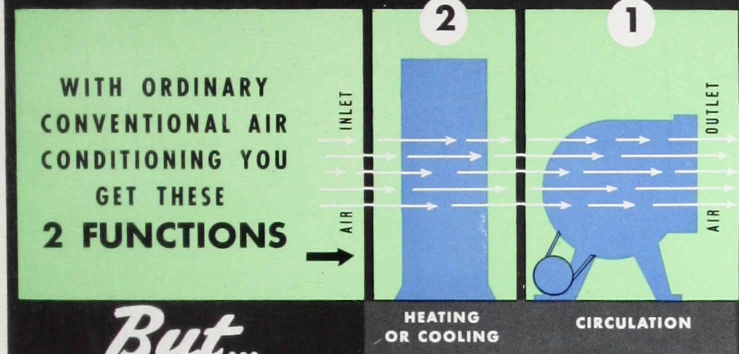
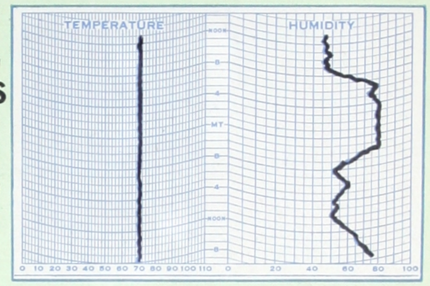
A NEW HIGH STANDARD IN AIR CONDITIONING

Modern AIR CONDITIONING IS—

THE SIMPLE STORY OF KATHABAR SELECTIVE ATMOSPHERES •



GIVES YOU THIS



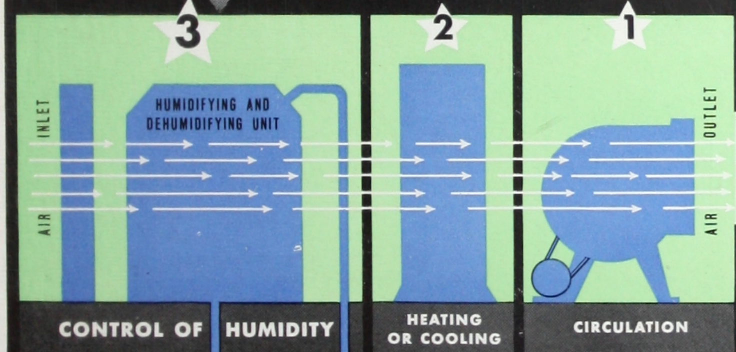
This conditioned space will give *chill, shock* and *clamminess* due to lack of humidity control. Air by-passing or reheating are utilized to better such conditions adding to initial and operating costs with unreliable results.

KATHABAR eliminates CHILL, SHOCK and CLAMMINESS . . creates *comfort* and *selective processing atmospheres* by independent handling of temperature and humidity. Note higher temperature maintained when humidity is lowered, reducing cooling and heating load — lessening operating costs.

But...

THE IMPORTANT FUNCTION (HUMIDITY CONTROL) IS MISSING UNTIL YOU INSTALL

THE KATHABAR SYSTEM



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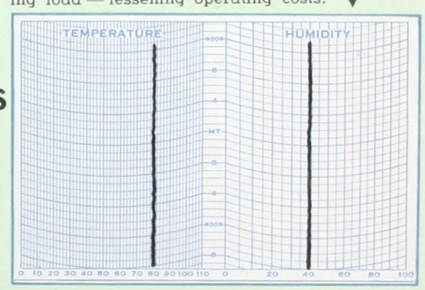
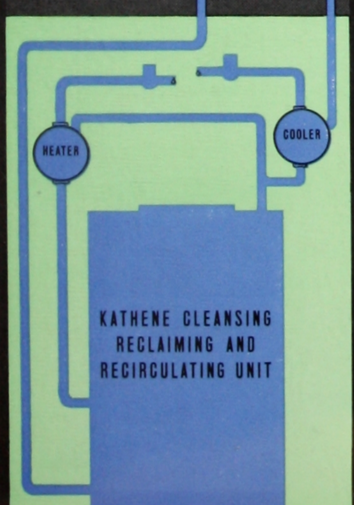




HOW KATHABAR OPERATES

☆3 The KATHABAR SYSTEM consists of two major parts:

Humidifying or Dehumidifying Unit (contactor or cell) placed on the roof or at conveniently located air intake. Single units or batteries provide the quantity of air required.

Kathene Cleansing, Reclaiming and Recirculating Unit (Regenerator) placed in remote part of building, often at some distance from Humidifying and Dehumidifying Unit. These units are connected by two pipes.

KATHENE LIQUID is the non-explosive, non-inflamable humidifying and dehumidifying agent that circulates through the pipes from contactors or cells to regenerator. In the contactors or cells the Kathene forms a "sheet-like" wash through which the incoming air must pass. Humidification or dehumidification is governed by the temperature of the Kathene liquid. The wash also serves to cleanse the air, remove foreign odor, and the chemical action renders certain bacteria inert. The Kathene then returns to the regenerator, where dirt and foreign particles are removed, moisture added or absorbed to bring the liquid to proper strength and is again recirculated. The Kathene is used over and over year after year.

The Kathabar System is simple and accurate in operation and only one valve is used to control Kathene temperature. Once set, the system is automatic. There's practically no service or operating costs. The motor on the recirculating pump is the only moving part.

☆2 The Kathabar System eliminates any necessity for attempting to balance coils to take care of both temperature and humidity or by-passing or reheating. When the incoming air is brought in contact with the heating and cooling coils, it has been humidity conditioned.

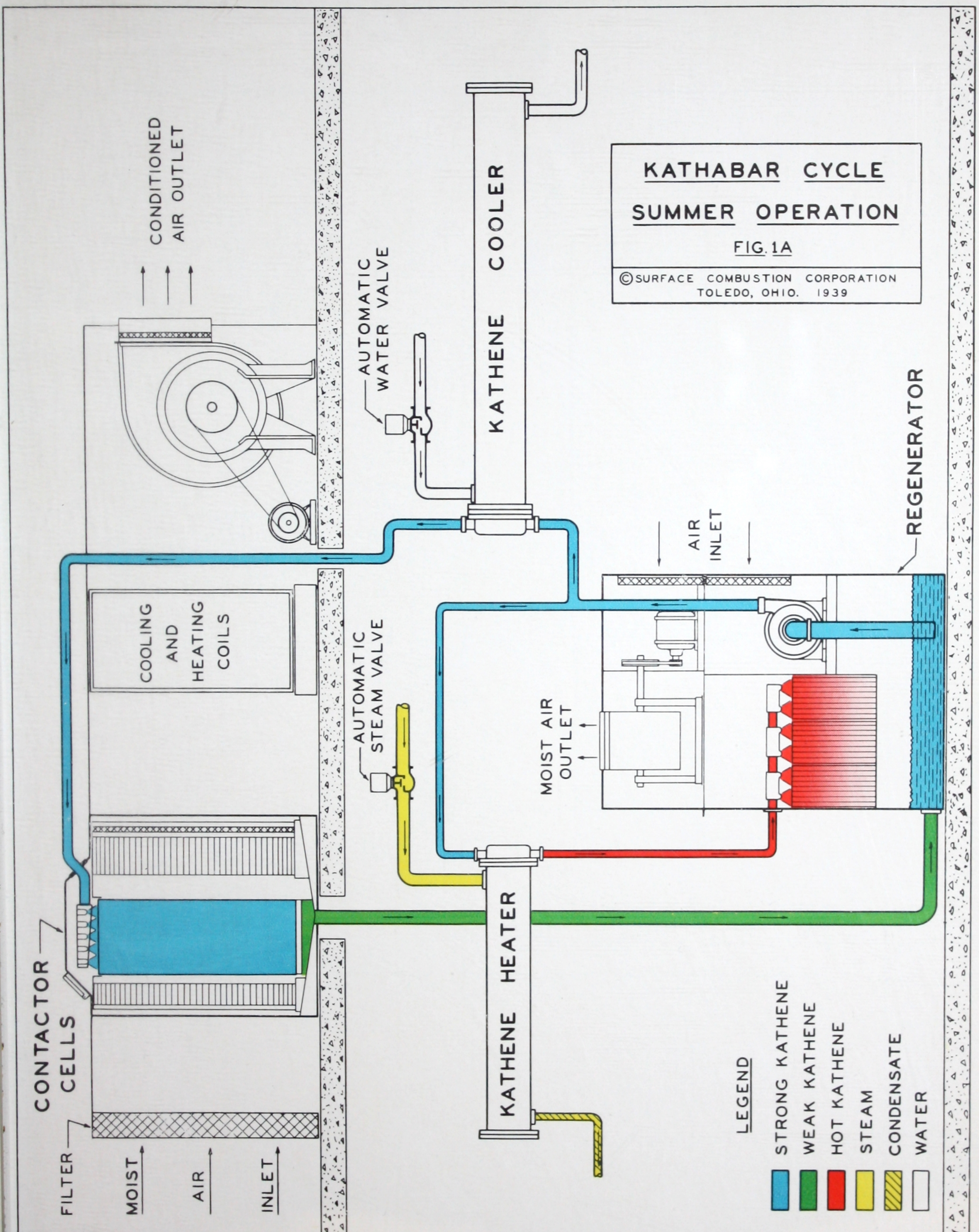
☆1 The fan simply keeps the conditioned air moving. Drafts are eliminated and so have been many other objectionable qualities.

Moisture -- The Problem in Air Conditioning

An excess or deficiency of moisture in the air, commonly called humidity, greatly affects the comfort and well-being of people, and the success of manufacturing operations which require certain specific air conditions. The known methods for "humidity control" other than KATHABAR have decided limitations in handling of moisture. KATHABAR has set up new higher standards for controlling humidity. It takes out or adds moisture, as desired, independently of any other treatment of the air. Other systems remove and supply moisture only at a sacrifice of other desired objectives.

Moisture removal by cooling usually produces a lower air temperature than is desired and causes CHILL, SHOCK and CLAMMINESS. Moisture added to air by steam is not accurately controllable. For these reasons, when the excess or deficiency of moisture in the outside air presents a humidity control problem, other systems than KATHABAR are definitely limited in their ability to handle fresh air in volume. It is easy for KATHABAR to handle large quantities of outside air providing an abundance of conditioned fresh air as desired. Where more humidity is needed, KATHABAR provides it by the same means used to remove an excess of humidity.

The volume of outside air treated presents no complication because KATHABAR provides complete and separate control of both moisture and temperature at all times.



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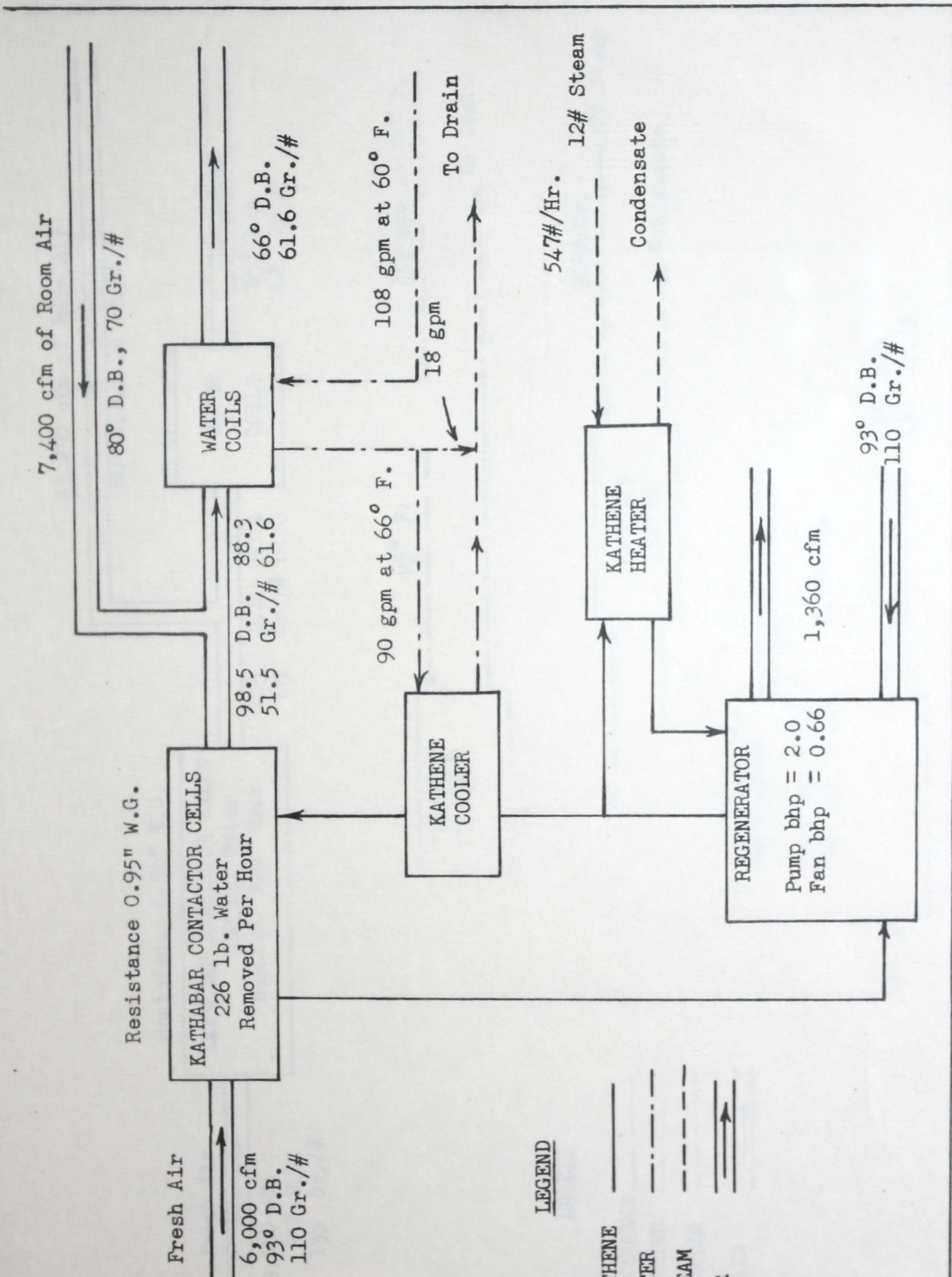

KATHABAR FLOW DIAGRAM FOR SAMPLE PROBLEM # 1

KATHABAR **SURFACE COMBUSTION CORPORATION • TOLEDO, OHIO**

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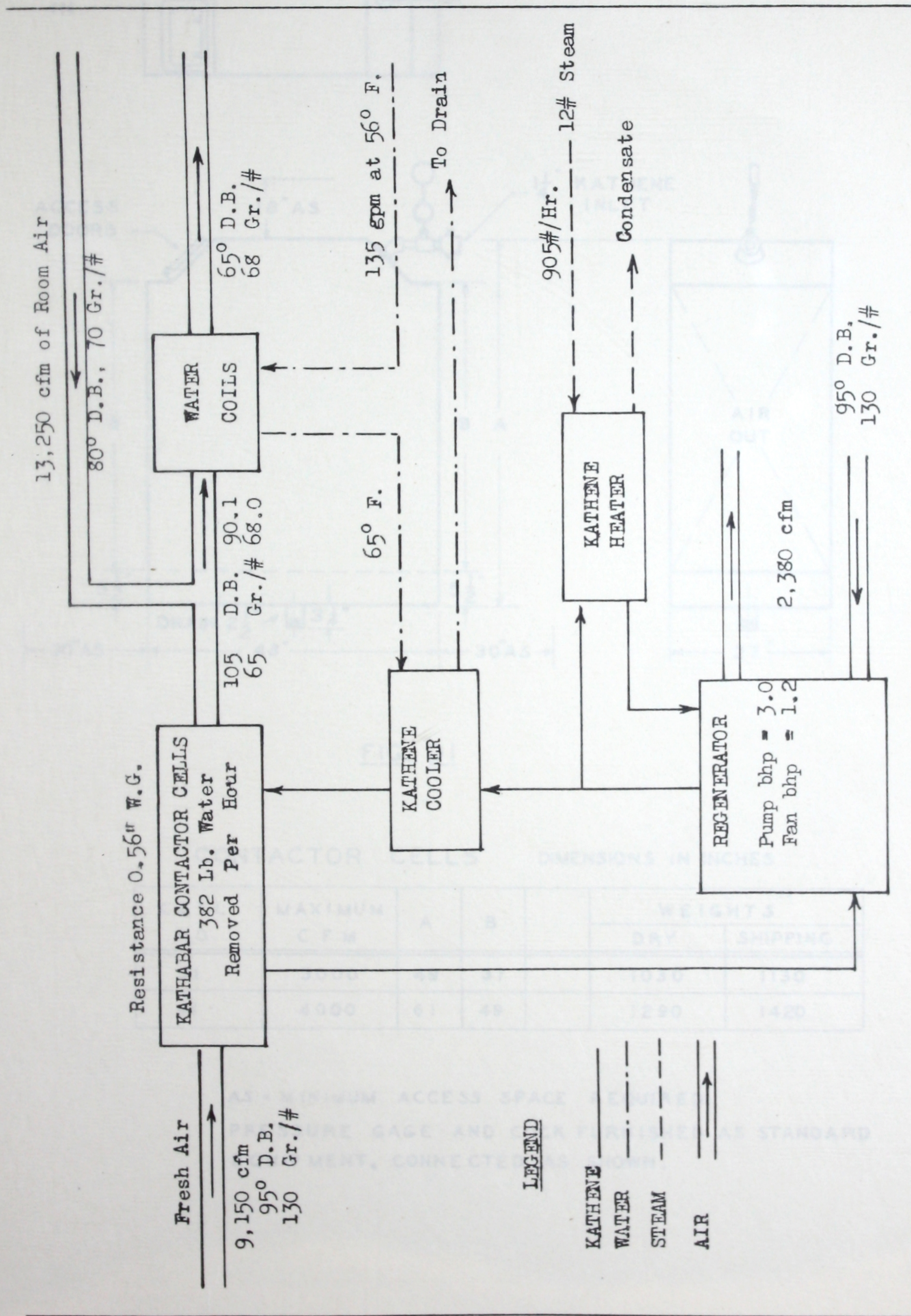


KATHABAR FLOW DIAGRAM FOR SAMPLE PROBLEM #2

CONTACTOR CELLS

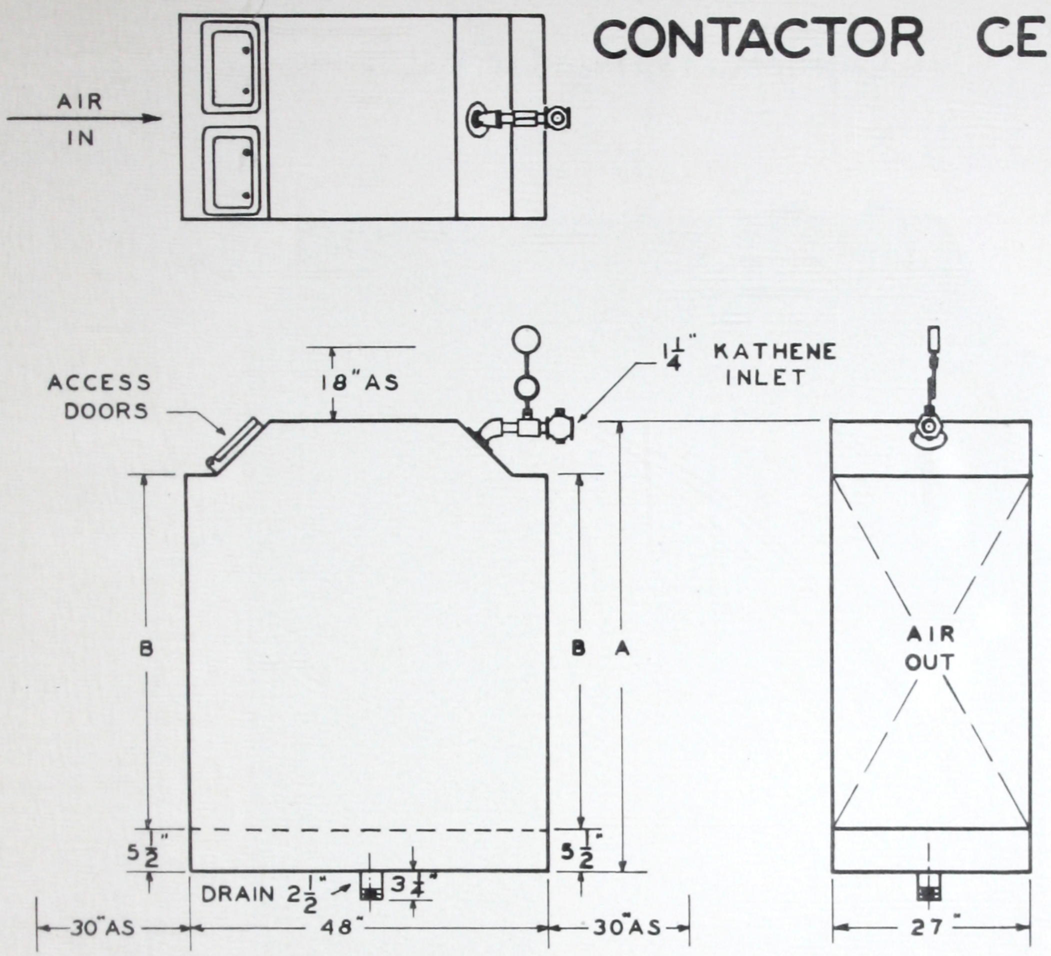


FIG. D1

CONTACTOR CELLS DIMENSIONS IN INCHES

CELL NO.	MAXIMUM CFM	A	B		WEIGHTS	
					DRY	SHIPPING
31	3000	49	37		1030	1130
41	4000	61	49		1290	1420

AS = MINIMUM ACCESS SPACE REQUIRED.

PRESSURE GAGE AND COCK FURNISHED AS STANDARD EQUIPMENT, CONNECTED AS SHOWN.

CONTACTOR CELLS

The air to be treated passes through one or more of these cells where the moisture, odors, fine dust particles, etc., are transferred from the air to the KATHENE. These cells are used in multiple numbers in connection with a regenerator, KATHENE cooler, pump and heater, to make up a complete KATHABAR operating unit. The Nos. 31 and 41 cells contain one section of contact surface in the direction of air flow.

CONTACTOR CELLS

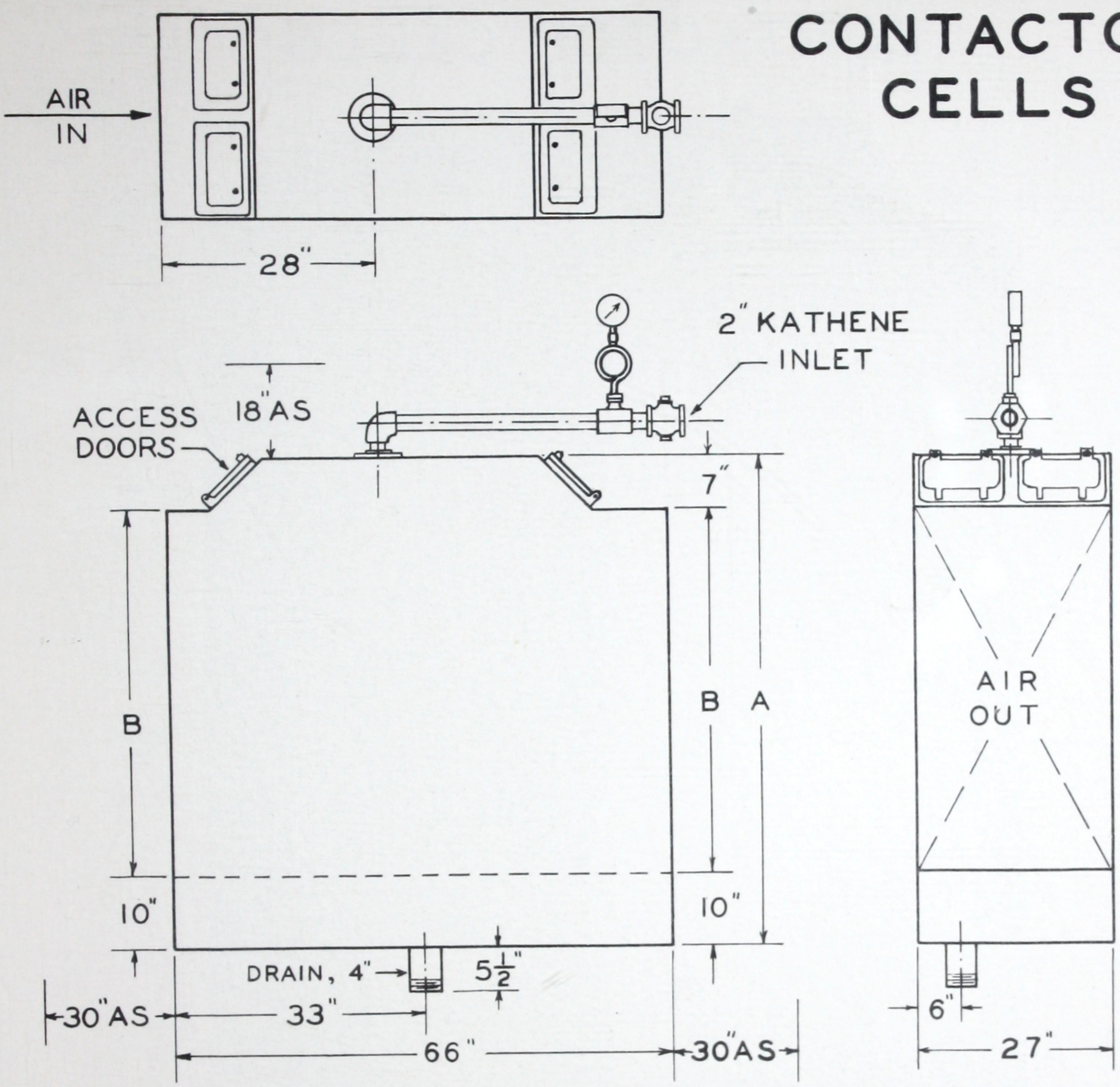


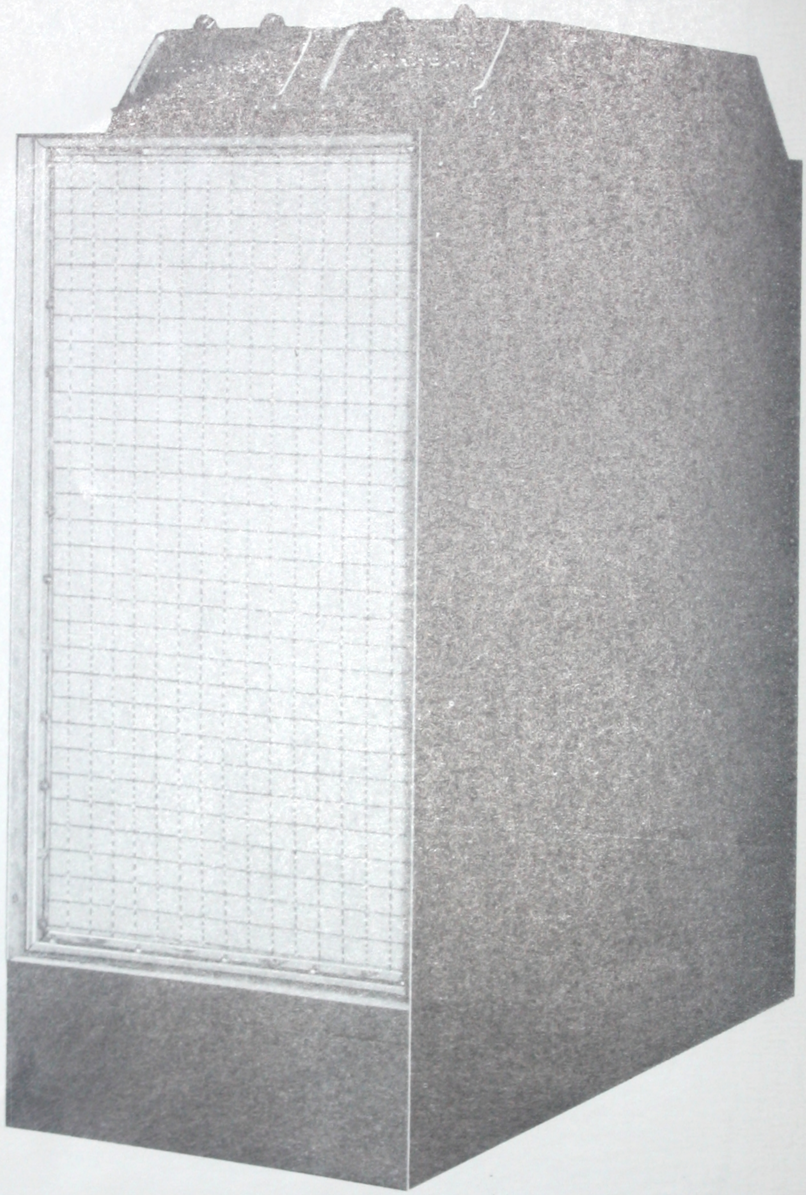
FIG. D2

CONTACTOR CELLS DIMENSIONS IN INCHES

CELL NO.	MAXIMUM CFM	A	B		WEIGHTS	
					DRY	SHIPPING
32	3000	54	37		1880	2070
42	4000	66	49		2350	2600

AS = MINIMUM ACCESS SPACE REQUIRED.
PRESSURE GAGE AND COCK FURNISHED AS STANDARD EQUIPMENT, CONNECTED AS SHOWN.

CONTACTOR CELLS



The air to be treated passes through an assembly of one or more of these contactor cells where the moisture, odors, fine dust particles, etc., are transferred from the air to the KATHENE. These cells are used in connection with a regenerator, KATHENE cooler, pump and KATHENE heater, to make a complete KATHABAR operating unit. The Nos. 32 and 42 designate that these cells have two sections of contact surface in the direction of air flow.

TABLE D1. Contactor Cell Data

Cell Size	Max. cfm	Resistance for cfm of 2500	3000	3500	4000	Dry Weight	Shipping Weight
#31	3000	0.73	0.95	-	-	1030	1130
41	4000	0.37	0.54	0.73	0.95	1290	1420
32	3000	1.05	1.35	-	-	1880	2070
42	4000	0.53	0.76	1.05	1.35	2350	2600

TABLE D2. Contactor Cell Ratings - Dehumidifying

Water Temp.	90°	85°	80°	75°	70°	65°	60°	55°
Inlet Air - Gr./#	Outlet Air - Gr./#							
130	70	65	60	55	52	48	45	41
120	68	62	57	53	49	45	41	39
110	65	59	54	50	46	43	39	37
100	62	57	52	48	44	40	37	35
90	59	54	49	45	41	38	34	33
80	56	51	46	42	38	35	32	30
70	53	48	43	39	35	33	30	28
60	51	45	40	37	33	30	27	26
50	49	44	38	34	30	27	25	23

The above table, when properly used, applies to the #31, 41, 32 and 42 contactor cells.

Example 1: For the #31 or #41 cells, with inlet air at 130 gr./#, using 80° water, the outlet air will be 60 gr./#.

The performance of the #32 or #42 cell amounts to placing two #31 cells in series or two #41 cells in series.

Example 2: Using the outlet air from example 1 as the inlet air, namely, 60 gr./# with 80° water, gives the outlet air as 40 gr./# for a #32 or #42 cell. When obtaining the outlet air conditions for a #32 or #42 cell, the same water temperature must of course be used in each step.

TABLE D3. Outlet D.B. Temperature from Cells for 95° D.B. Inlet Air

Water Temp.	90°	85°	80°	75°	70°	65°	60°	55°
Inlet Air - Gr./#				Outlet Air D.B., °F.				
130	107	105	102	100	97	94	92	89
120	107	104	102	99	96	94	91	88
110	106	103	101	98	95	93	90	87
100	105	103	100	98	95	92	89	86
90	105	102	100	97	94	91	88	85
80	104	102	99	96	93	90	87	84
70	104	101	99	96	92	89	86	83
60	103	101	98	95	92	88	85	82
50	103	100	97	94	91	88	84	81

TABLE D4. Outlet D.B. Temperature from Cells for 85° D.B. Inlet Air

Water Temp.	90°	85°	80°	75°	70°	65°	60°	55°
Inlet Air - Gr./#			Outlet Air D.B., °F.					
130	101	99	98	96	93	90	87	84
120	100	99	97	95	92	89	86	83
110	100	98	97	95	92	89	86	83
100	100	98	96	94	91	88	85	82
90	99	97	96	93	90	87	84	81
80	99	97	96	93	90	87	84	80
70	99	97	95	92	89	86	83	79
60	98	96	94	92	89	85	82	79
50	98	96	94	91	88	85	82	78

TABLE D5. Contactor Cell Ratings - Humidifying

Inlet Air Gr./#	3	10	20	30	40	50
Outlet Air Gr./#	43	45	48	51	53	55
Outlet Dry Bulb	84	86	88	90	91	92

Note: The above outlet dry bulbs based on inlet dry bulb of 50°.

REGENERATORS NOS. 1A TO 8A

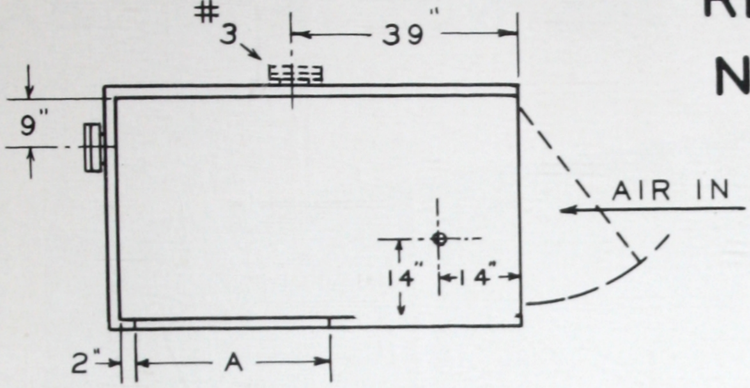
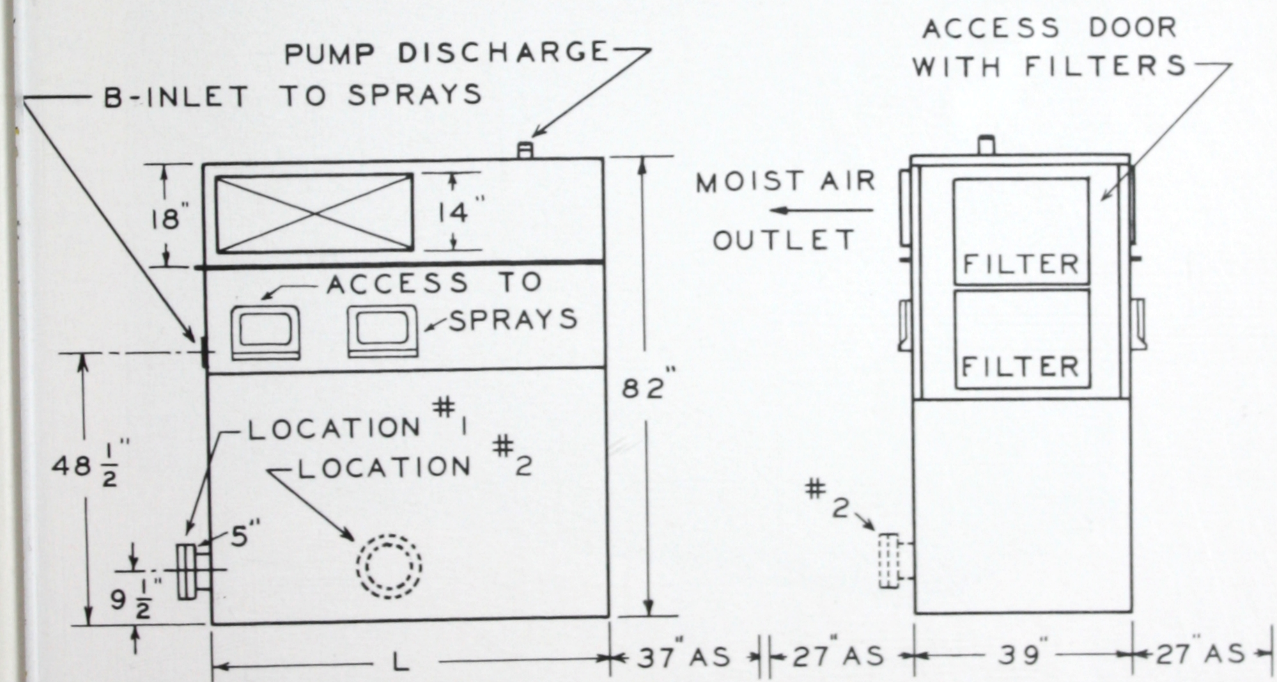
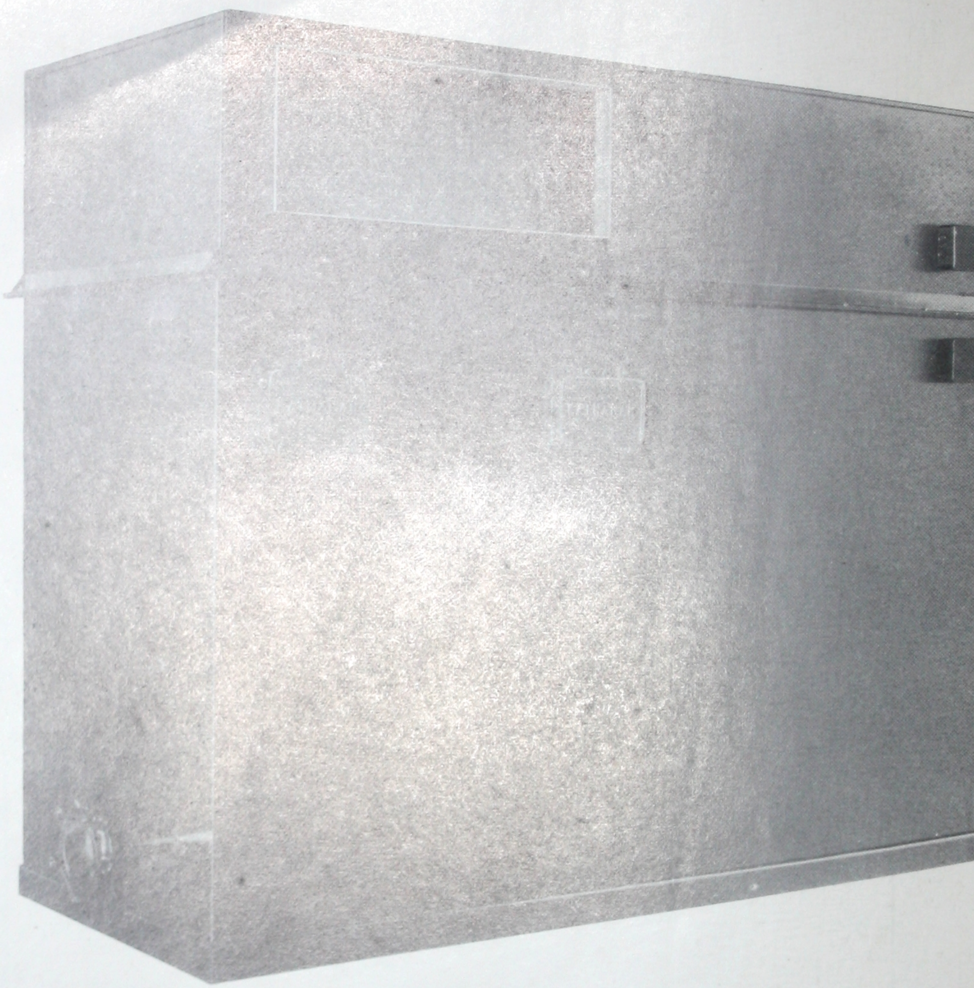


FIG. E1



DIMENSIONS IN INCHES					WEIGHTS-LBS		NOTES
UNIT	L	A	B		DRY	SHIPPING	AS = MINIMUM ACCESS SPACE REQUIRED.
NO. 1A	49	17	1½		1350	1500	
2A	49	17	1½		1440	1600	
3A	49	17	1½		1540	1700	PUMPS INCLUDED IN WEIGHTS GIVEN.
4A	49	17	1½		1630	1800	
5A	70	34	2		2080	2200	
6A	70	34	2		2170	2400	THESE UNITS DO NOT HAVE FANS.
7A	70	34	2		2270	2500	
8A	70	34	2		2360	2600	12-31-40

REGENERATORS NOS. 1A TO 8A



The moisture, odors, etc. absorbed by the KATHENE in the contactor cells are removed from the KATHENE by the regenerator. The regenerator is used in connection with a number of contactor cells, KATHENE cooler and heater, to make a complete KATHABAR operating unit. The regenerator size numbers 1 to 8 refer to the number of sections of contactor surface in each. The ratings per section are given in the regenerator capacity table. These regenerators Nos. 1A to 8A include the sump, KATHENE pump and KATHENE filter, but do not include regenerator air fan.

NO.16A REGENERATOR

DRY WEIGHT 5500 LBS. SHIPPING WEIGHT 6050 LBS. PUMP NOT INCLUDED SINCE NO SPACE IS AVAILABLE FOR A PUMP IN THIS UNIT. AS MINIMUM ACCESS SPACE, UNIT HAS NO REGENERATOR AIR FAN.

1-13-41

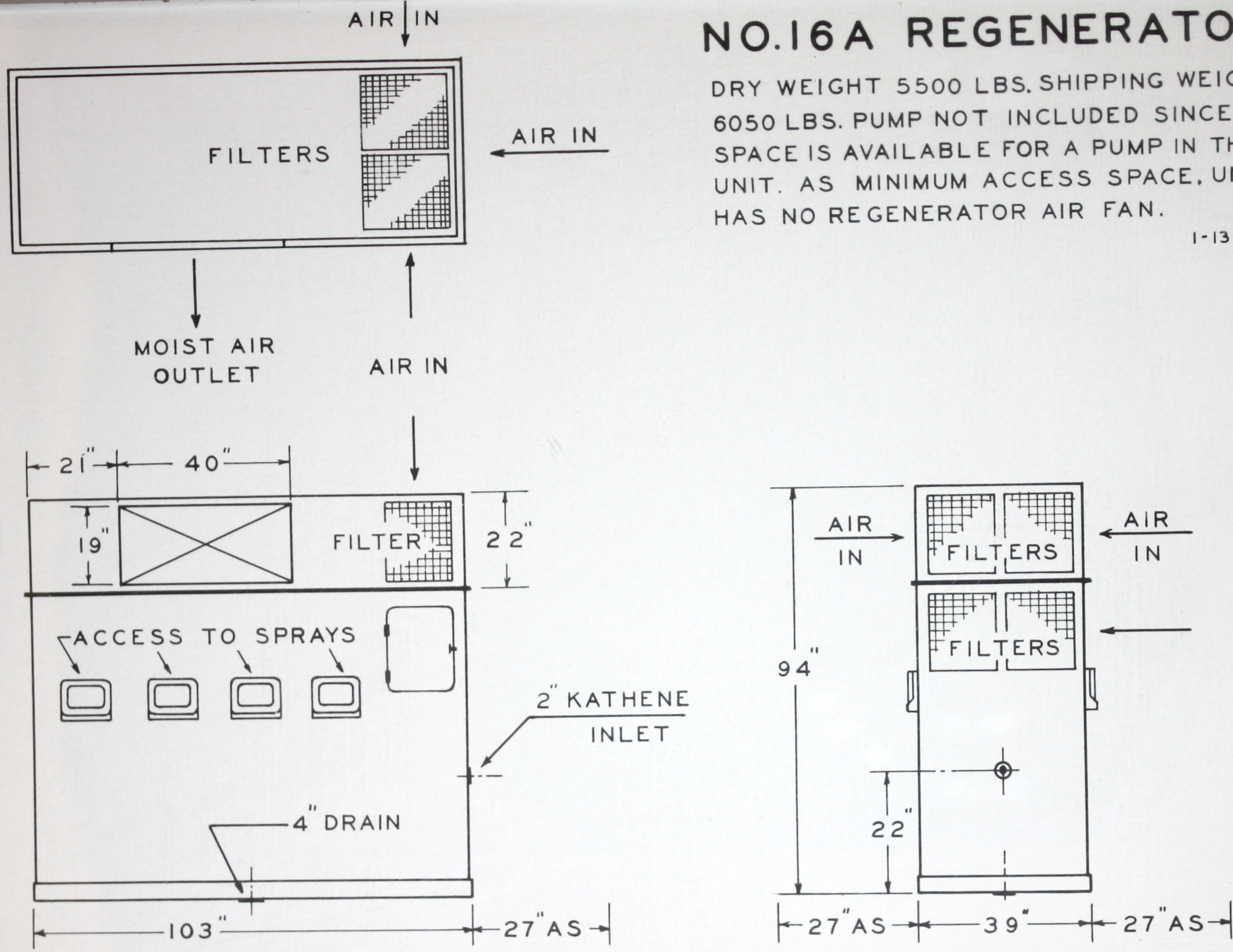
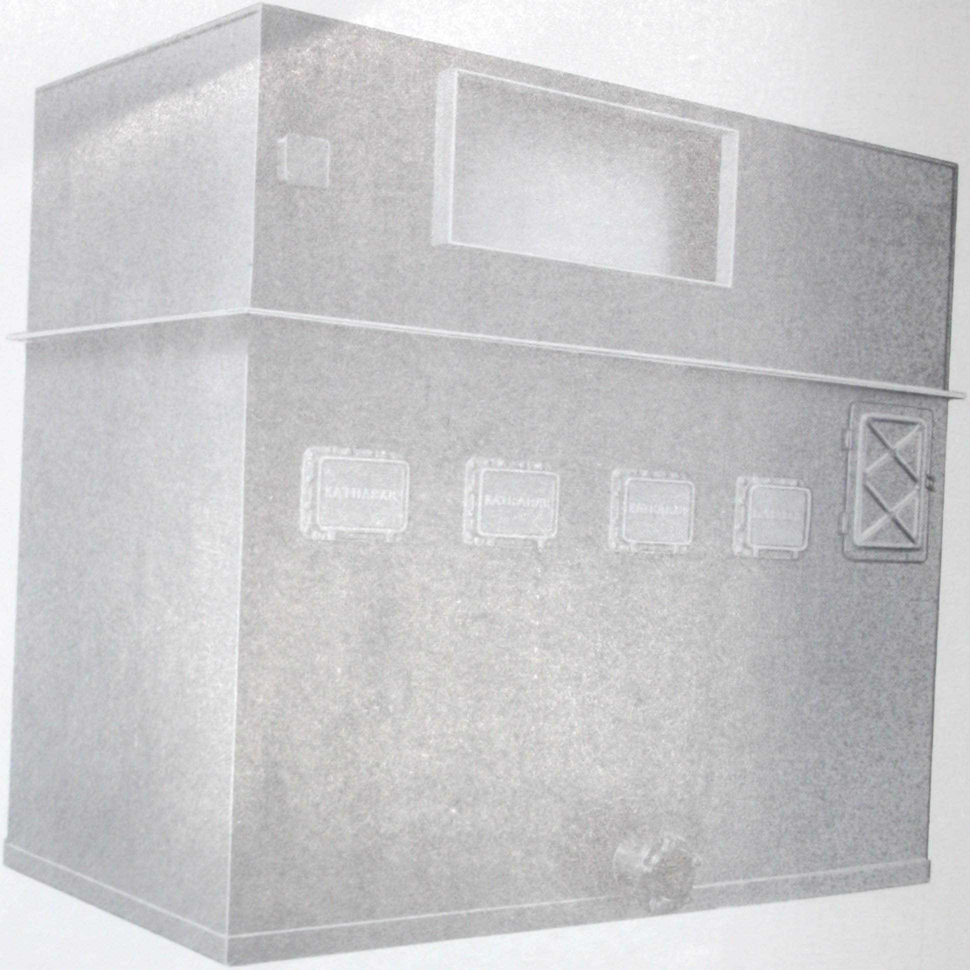


FIG. E3

NO. 16A REGENERATOR



The moisture, odors, etc., absorbed by the KATHENE in the contactor cells are removed from the KATHENE by the regenerator. The regenerator is used in connection with a number of contactor cells, KATHENE coolers and heaters, to make a complete KATHABAR operating unit. This regenerator contains sixteen sections of contactor surface, but no regenerator air fan. Usually on a job requiring a No. 16A regenerator, it will be necessary to mount the KATHENE pump externally from the regenerator and to use a separate tank sump to hold the main body of KATHENE. In such cases it will be necessary to elevate the regenerator approximately four feet about the sump level so the solution from the regenerator may drain back by gravity to the main sump.

TABLE E1. **Regenerator Data**

Unit No.	Dimensions in inches W	x L	x H	Approx. Shipping Weight	Fan bhp for External Resistance of: 0.1"	0.2"	0.3"	Fan Motor hp	Air Req. cfm	Operating Gals.Req.	Sump Capacity Gallons
1	39	49	82	3020	0.12	0.14	0.17	1/4	340	28	200
2	39	49	82	3120	0.17	0.20	0.23	1/3	680	35	200
3	39	49	82	3220	0.34	0.36	0.38	1/2	1020	42	200
4	39	49	82	3320	0.55	0.66	0.77	1	1360	49	200
5	39	70	82	3550	0.60	0.72	0.84	1	1700	67	390
6	39	70	82	3650	0.65	0.78	0.91	1-1/2	2040	74	390
7	39	70	82	3750	1.00	1.20	1.40	2	2380	81	390
8	39	70	82	3850	1.10	1.30	1.50	2	2720	88	390
9	57	89	94	5130	1.20	1.40	1.60	2	3060	75	770
10	57	89	94	5260	1.30	1.50	1.70	2	3400	75	770
*16	39	103	94	6100	2.00	2.30	2.60	3	5440	*	*

*Separate tank sump required. In any case where the capacity of the system exceeds sump capacity given above, a separate tank sump will be required and regenerator must be elevated above sump so KATHENE can drain back to tank sump by gravity.

KATHENE COOLERS

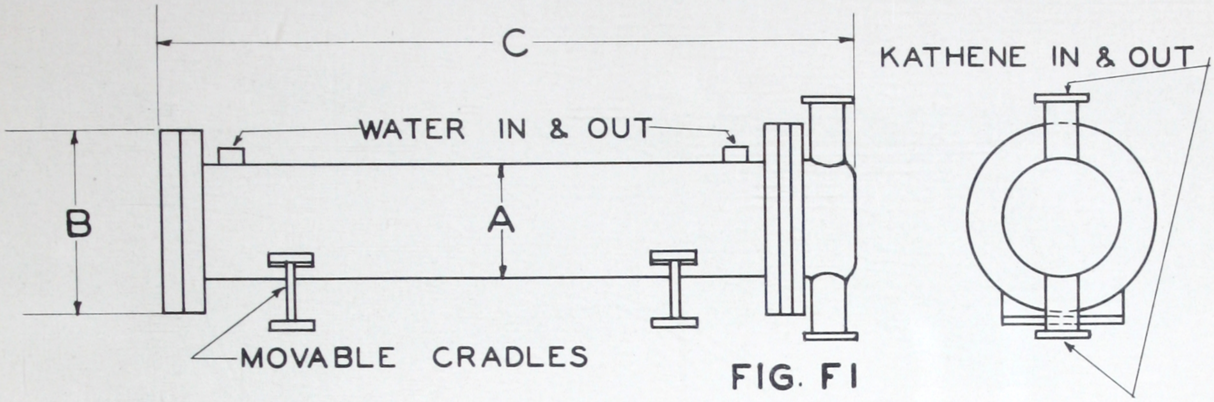
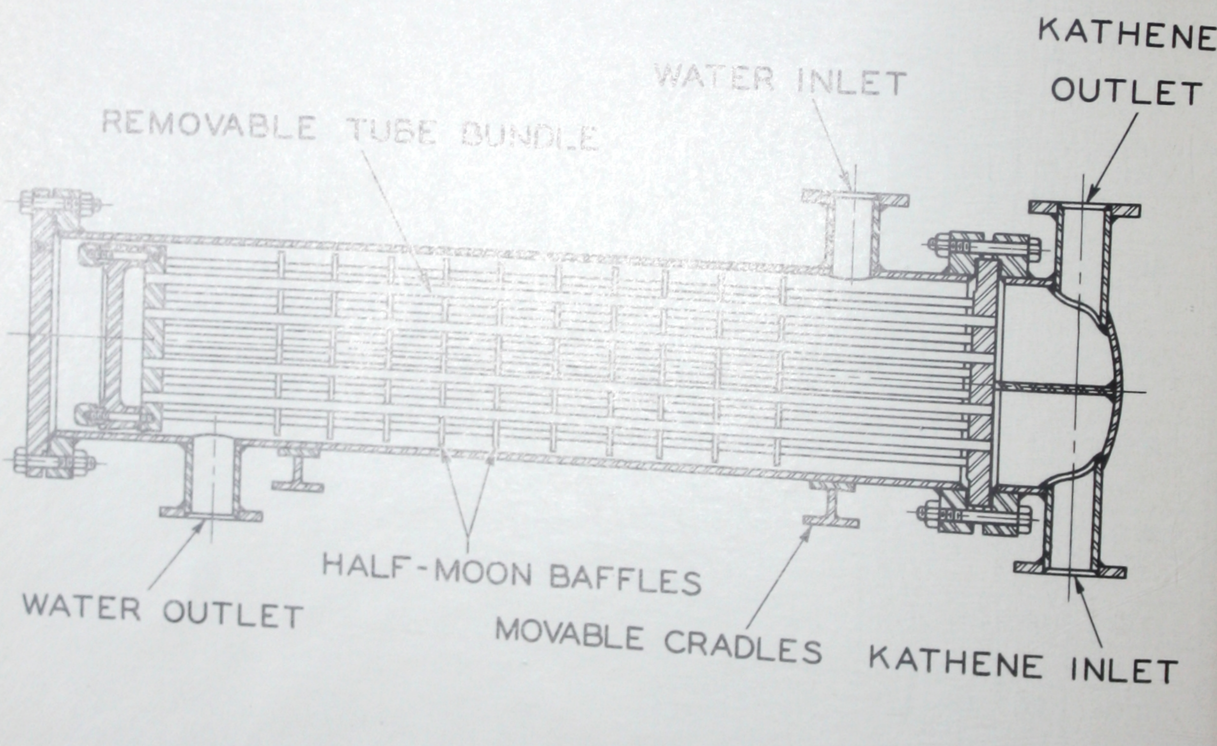


FIG. F1

DIMENSIONS IN INCHES									WEIGHTS IN POUNDS			
COOLER NO.	A	B	C		G3	G1			WEIGHT C3		WEIGHT C1	
									DRY	WET	DRY	WET
610	7	11	129		37	32			505	640	527	648
X			12		3	3			40	53	38	50
810	9	14	130		70	63			720	953	680	896
X			12		6	5			50	72	45	65
1010	11	16	130		11.3	11.7			1130	1493	1090	1420
X			12		9	10			80	114	75	107
1210	13	19	132		176	180			1490	2016	1440	1940
X			12		14	14			100	150	95	140
1410	15	21	133		254	270			1970	2696	1940	2620
X			12		20	20			150	217	145	210
1710	18	24	135		416	420			3000	4086	2910	3900
X			12		31	35			200	300	190	280
1910	20	28	136		467	537			3750	5050	3600	4850
X			12		36	50			250	370	250	370
2110	22	30	147		595	690			4600	6230	4500	6045
X			12		45	54			300	447	300	440

X=EXTRA PER FOOT OF LENGTH. G=GALLONS OF KATHENE REQD. THE LAST TWO DIGITS IN THE COOLER NO. GIVE THE TUBE LENGTH. EXAMPLE: FOR A NO. 1710 THE TUBE LENGTH IS 10 FEET. A NO. 1712 WOULD HAVE 12 FOOT TUBES AND BE 2 FEET LONGER THAN NO. 1710. C_3 IS FOR COOLERS HAVING $\frac{3}{4}$" O.D. TUBES. C_1 IS FOR 1" O.D. TUBES.

KATHENE COOLERS



One or more of these Coolers control the amount of moisture removed in the Contactor Cells by cooling the KATHENE solution, using water as the cooling medium. The flow of water to the KATHENE Coolers is controlled by an automatic water valve.

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TOLEDO, OHIO

TABLE F6. KATHENE Cooler Sizes for Various Surfaces

No. of Cells	1	2	3	4	5
Sq Ft Surface			**KATHENE Cooler Size**		
50	1005 C3				
100	1010 C3	-			
150	1213 C1	-	1409 C1		
200	2-1208 C1	1411 C1	-	-	
250	2-1211 C1	1414 C1	-	-	
300	2-1213 C1	2-1213 C1	1710-1/2 C1	-	
350	2-1216 C1	2-1410 C1	1712 C1	-	-
400		2-1411-1/2 C1	1714 C1	-	-
450		2-1413 C1	2-1708 C1	1912-1/2 C1	-
500		2-1414 C1	2-1708-1/2 C1	1914 C1	-
600		2-1417 C1	2-1710-1/2 C1	-	1916-1/2 C1
700			2-1712 C1	-	2115-1/2 C1
800			2-1713-1/2 C1	-	-
900			2-1715-1/2 C1	2-1912-1/2 C1	2-1715-1/2 C1
1000				2-1914 C1	-
1200				2-1916-1/2 C1	-
1300				3-1715 C1	-
1400					2-2116 C1
1500					3-1914 C1

Sq Ft Surface	6	7	8	9	10
300	1710-1/2 C1				
400	1714 C1	-			
500	1914 C1	-	-		
600	1916-1/2 C1	-	-	-	-
700	2115-1/2 C1	-	-	-	-
800	2-1714 C1	-	-	-	-
900	2-1715-1/2 C1	-	-	-	-
1000	2-1717 C1	-	-	-	-
1100	2-1915 C1	-	-	-	-
1200	2-1916-1/2 C1	-	-	-	-
1300	2-2114-1/2 C1	-	-	-	-
1400	2-2115-1/2 C1	-	-	-	-
1500	2-2116-1/2 C1	-	-	-	-
1600	3-1915 C1	-	-	-	-
1700	3-1915-1/2 C1	-	-	-	-
1800	3-1916-1/2 C1	-	-	-	-
1900		4-1913 C1	-	-	-
2000		4-1914 C1	-	-	-
2200		4-1915 C1	-	-	-
2400			4-1916-1/2 C1	-	-
2600			4-2114-1/2 C1	-	-
2800				4-2115-1/2 C1	-
3000					4-2116-1/2 C1

Note: When space contains a dash, use the cooler size given in column to left. Example: 700 sq ft for 7, 8, 9, or 10 cells, use a 2115-1/2 C1 cooler. For more than 10 cells use multiples of above cooler sizes. Example: Required 2600 sq ft for 18 cells; use 4-2114-1/2 C1 coolers.

KATHENE HEATERS

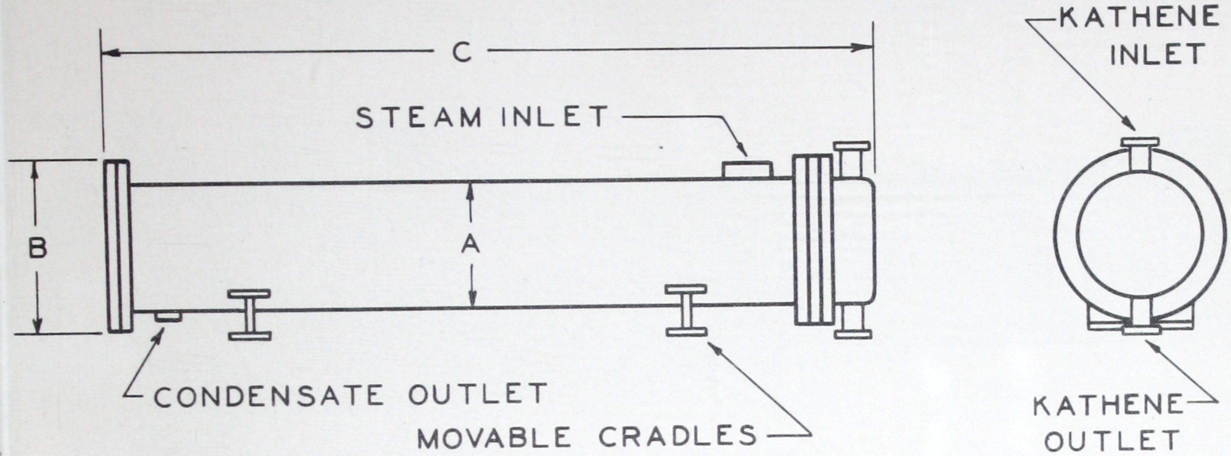


FIG. G1

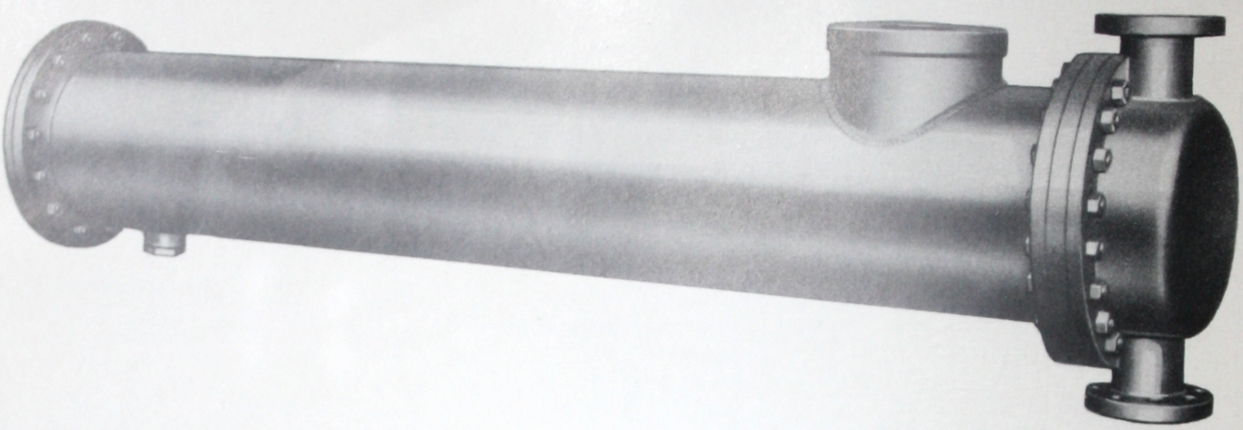
DIMENSIONS IN INCHES							WEIGHTS IN POUNDS			
							WEIGHT H_3		WEIGHT H_1	
HEATER NO.	A	B	C	G_3	G_1		DRY	WET	DRY	WET
610	7	11	129	3.7	3.2		460	500	480	510
X			12	.3	.3		35	38	33	36
810	9	14	130	7.0	6.3		660	740	620	690
X			12	.6	.5		40	46	35	40
1010	11	16	130	11.3	11.7		1060	1180	1030	1160
X			12	.9	1.0		65	75	63	74
1210	13	19	132	17.6	18.0		1420	1600	1370	1560
X			12	1.4	1.4		80	95	75	90
1410	15	21	133	25.4	27.0		1920	2190	1890	2180
X			12	2.0	2.0		120	141	115	136
1710	18	24	135	41.6	42.0		2930	3370	2840	3290
X			12	3.1	3.5		160	193	150	187

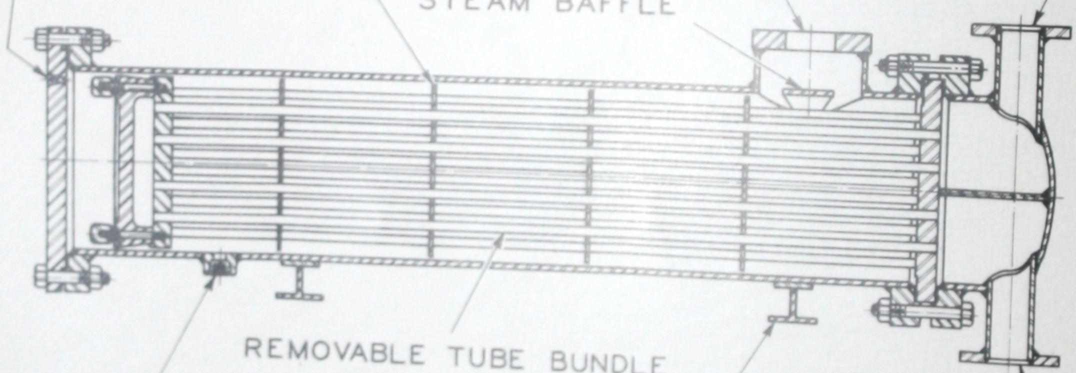
X= EXTRA PER FOOT OF LENGTH. G=GALLONS OF KATHENE REQUIRED.

THE LAST TWO DIGITS IN THE HEATER NO. GIVE THE TUBE LENGTH. EXAMPLE: FOR A NO. 1710 THE TUBE LENGTH IS 10 FEET. A NO. 1712 WOULD HAVE 12 FOOT TUBES AND BE 2 FEET LONGER THAN THE 1710

H_3 IS FOR HEATERS WITH $\frac{3}{4}$" TUBES. H_1 HEATERS HAVE 1" TUBES.

KATHENE HEATERS





These heaters, using steam for the heating medium, heat the KATHENE before it enters the regenerator. When used in connection with contactor cells, regenerator, and KATHENE coolers, a complete KATHABAR operating unit is the result.

KATHABAR SC **SURFACE COMBUSTION · TOLEDO, OHIO**

A NEW HIGH STANDARD IN AIR CONDITIONING

TABLE G1. KATHENE Heater Surfaces and Steam Rates per Pound of Moisture Removed. Table Based on 12# Steam.

Maximum Water Temperature	90	85	80	75	70	65	60
#Steam/# Moisture	2.35	2.37	2.40	2.43	2.46	2.51	2.57
SqFt/# Moisture/hr.	0.44	0.44	0.44	0.44	0.44	0.44	0.44

Multipliers	25# Steam	5# Steam	3# Steam
Multiply steam rates by	1.00	1.08	1.11
Multiply sq ft surface by	0.65	1.25	1.37

Note: The above maximum water temperatures correspond to water temperatures given on Table D2, Contactor Cell Ratings

TABLE G2. KATHENE Heater Sizes for Various Surfaces

No. Regen. Sections / Sq ft Surface	1	2	3	4	5
	KATHENE Heater Size				
10	603 H3				
20	607 H3				
30	610 H3	805 H3			
40		806-1/2 H3	-		
50		808 H3	-	-	
75		812 H3	1007-1/2 H3	-	-
100			1010 H3	-	-
125				1208 H3	-

No. Regen. Sections / Sq ft Surface	6	7	8	9	10
100	1010 H3	-			
125	1208 H3	-	-		
150	1209-1/2 H3	-	-		
175	1211 H3	1408 H3	-	-	-
200		1409 H3	-	-	-
225			1410 H3	-	-
250				1411-1/2 H3	-
275					1412-1/2 H3

Note: When space contains a dash, use heater size given in column to left.

TABLE G3. KATHENE Humidifying Heater Surfaces and Steam Rates Per 1,000 cfm. Table Based on 12 Pound Steam and 50° Inlet Dry Bulb to Cells (See Table D5.)

Inlet Air Gr./#	3	10	20	30	40	50
Sq. Ft. Surface	3.4	3.3	3.2	3.0	2.8	2.7
# Steam	69.5	68.0	65.0	61.0	57	53

For 5# steam multiply above surfaces by 1.13.

For 3# steam multiply above surfaces by 1.17.

TABLE G4. KATHENE Humidifying Heater Sizes for Various Surfaces

No. of Cells	1	2	3	4	5
Sq. Ft. Surface	KATHENE Humidifying Heater Size				
10	504 A	-			
20	508 A	-			
30		607 A	-		
40		610 A	-		
50			806 A	-	
60			807 A	-	
70				808 A	-
80				809 A	-
90					810 A
100					811 A

	6	7	8	9	10
80	809 A				
90	810 A	-			
100	811 A	-			
110	1008 A	-			
120		1009 A	-		
130		1010 A	-		
140			1207 A	-	
160			1208 A	-	
180				1209 A	-
200				1210 A	-

Note: When space contains a dash, use heater size given in column to left. For more than 10 cells use multiples of the above heaters.

SC

Kathabar

HUMIDITY CONTROL SYSTEM

{ PACKAGE UNIT }

SC Kathabar

HUMIDITY CONTROL SYSTEM

PACKAGE UNIT

For Smaller Demands... Gives the Same Constant, Dependable Performance in Controlling Humidity as the Larger Central System.

THE need for a simple, dependable humidit control system for small demands can be met with the ne series Kathabar Package Units. For many years Kathabar w available only in large central systems. Hundreds of these in stallations now serve in varied applications for comfort, an where consistent production and constant quality depend upo absolute air moisture control. Now, the same dependabili has been built into the Kathabar Package Unit for limited, co trolled air output.

KATHABAR, a Product of Surface Combustio

For over 35 years, Surface Combustion has been recogniz as a leading manufacturer of gas-fired heating equipment i cluding SC Industrial Furnaces for the metal working industr and Janitrol home and commercial space heating units. Du ing research and development of this complete line of heatir equipment, SC engineers were confronted with the proble of humidity control. This brought about development of th Kathabar system . . . a most simple, dependable method f harnessing air moisture.

Since that time Kathabar systems have enjoyed an ever i creasing acceptance for commercial and industrial applicatior This satisfaction of use is proven testimony of their operatir efficiency and economy.

The Unit with Many Outstanding Features

Unlike any other principle, now commonly used for dehumidifying or drying the atmosphere, Kathabar dehumidifies or humidifies to maintain just the desired percentage of relative humidity in the air that is needed for the particular application. This *balanced* control of humidity is handled independently of atmospheric temperature.

Furthermore, precooling, reheating and bypassing of the air for the purpose of eliminating humidity is obsoleted by the Kathabar system. It utilizes a single, one-path air flow, eliminating costly and complicated operations.

Recharging of the system is unnecessary. Maintenance is practically nil. Operation is within the scope of any workman—only one simple control. Waste steam is used for heating, where available. Well or city water provides most economical cooling. Refrigeration can be used. Electricity is used for small recirculating motors only. Total fuel required is in direct proportion to the total load. Operating cost is minimized.

4 Practical Sizes

Kathabar Package Units are available in sizes for 750, 1500, 3500 and 5000 c.f.m. These are conservative ratings to assure capacity and to keep the size within a minimum total space requirement. Comparatively, Kathabar units are lighter in weight, smaller in size, have greater flexibility of application than present drying systems.

Solving Moisture Problems in Many Fields Such as:

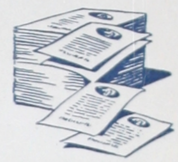
RESEARCH AND DEVELOPMENT—In industrial and commercial laboratories—in experimental stations, or wherever there is need for accurately controlled humidity, Kathabar systems are ideal. Units now being used by leading universities and industrial plants.

FOOD PRODUCTS—In processing, packaging, storage and warehousing, and distribution of many foods such as cereals, dehydrated fruits, vegetables or meats, where there is danger of moisture regain, the Kathabar system will protect product quality and maintain saleability.

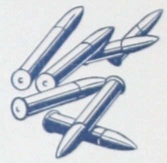
BAKERY PRODUCTS—One of the first Kathabar installations ever to be made was in the plant of a nationally known baker, and used for drying icings on cookies and cakes. Numerous applications in the processing and storage of raw and finished products in the baking field can be handled most satisfactorily with Kathabar.

PHOTOGRAPHIC SUPPLIES—A leading manufacturer of sensitized paper and film has purchased the sixteenth Kathabar unit for processing purposes. A number of other such plants have Kathabar units, too.

DRUGS AND PHARMACEUTICALS—Powders, compounds, coated and uncoated tablets and pills, gelatin capsules, etc. are being manufactured with the use of Kathabar systems. The effect of variable weather conditions on the processing of these products has been eliminated. Daily production can be maintained and quality preserved.



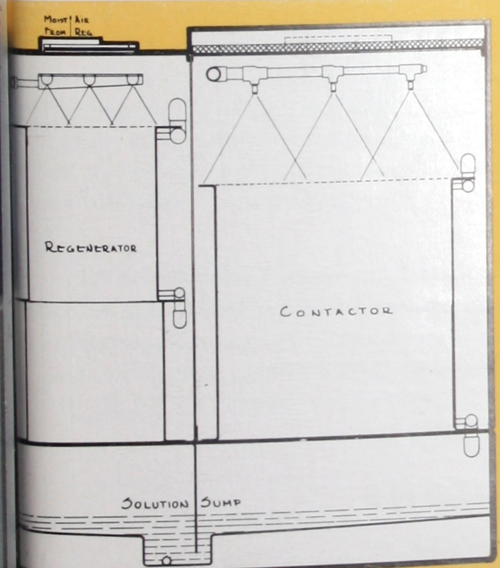
PAPER AND PAPER PRODUCTS—Every printer and lithographer knows the value of proper paper conditioning for accurate register of color work. Kathabar gives just the desired humidity content to conditioning or storage atmospheres. Carbon paper manufacture is benefited by Kathabar according to a leading maker.



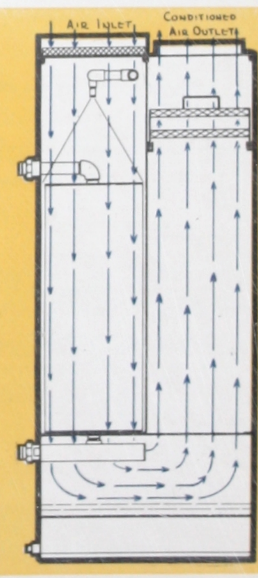
MUNITIONS—Many Kathabar Package Units are going into arsenals for use in loading shells. The balanced control of air moisture is vital to the proper conditioning of powder. Other war product applications are aircraft manufacturing (plastic plywood planes), storage of delicate instruments, etc.

CUPOLA DRY BLAST—A constantly growing number of foundries are installing Kathabar systems for dry blast to increase metal quality and speed production. Other metal industry applications include blast furnaces, non-ferrous foundries and powdered metals.

Wherever variable humidity conditions are harmful to product quality or affect speed of production, or wherever *chill, shock* and *clamminess* are objectionable features to personal comfort, Kathabar Humidity Control Systems will give *balanced control* of the air moisture.



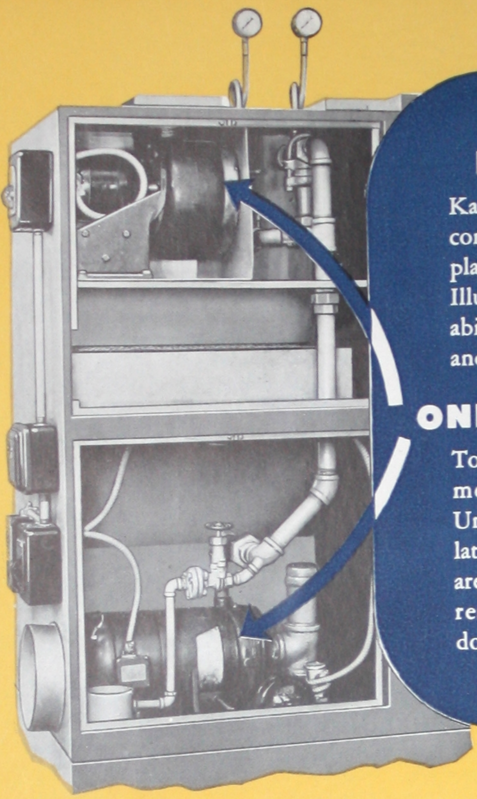
THE *Kathabar* PRINCIPLE OF OPERATION



● The Kathabar system utilizes a chemical absorption medium for controlling the moisture content of the atmosphere. This solution, known as Kathene, is a single salt with a low vapor pressure. Its capacity and rate of absorption are determined by its temperature. Kathene does not deteriorate with age and can be used continuously. It is non-corrosive. In fact it acts as a protector to the surfaces with which it comes in contact.

The operation consists of bringing the outside air in contact with the Kathene solution. This is accomplished by the use of a contactor cell. At this point the air is "washed" by the solution which adds to, or removes moisture in accordance with the desired, single control setting. Solution temperature is maintained by modulating the water to the contactor-cooler. This operation is automatic.

A small percentage of the solution is regenerated to return all the solution to normal strength. Then it is recirculated. This cycle continues without interruption. As the solution is filtered during the regenerating process, it is possible to use Kathabar systems in dust-laden atmospheres. Furthermore, the solution tends to cleanse and sterilize the atmosphere and in many cases is effective in removing objectionable odors.



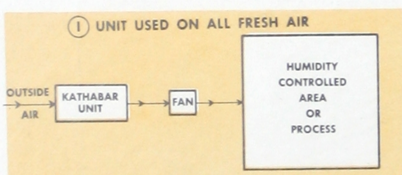
EASY TO INSTALL

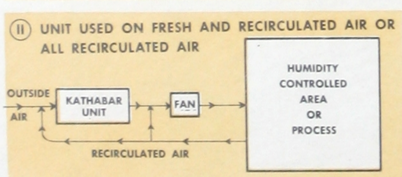
Kathabar Package Units are shipped completely assembled, ready to set in place, make connections and operate. Illustration at the right shows availability of pipe connections for steam and water.

ONLY 2 MOVING PARTS

To the left is illustrated the complete mechanism of Kathabar Package Units. Two small motors, the recirculating pump and excess moisture fan are the only moving parts and are readily available by removing two doors at the side of the unit.

TYPICAL APPLICATION DIAGRAMS





All Fresh Air

Many industrial jobs require all outside air with no recirculation. Comfort installations can usually be accomplished by dehumidifying the fresh air to low enough humidity to absorb the internal moisture load. Kathabar dehumidifies air from high to low humidity without precooling or bypassing and usually without reheating or aftercooling.

Fresh and Recirculated Air or All Recirculated Air

For industrial processing where a low exit moisture is desired and where recirculation is permissible. The amount of recirculated air put through the Kathabar unit is dependent upon desired outlet conditions. In some cases 100% recirculated air is used through the Kathabar unit.

GENERAL SPECIFICATIONS

Model No.	Capacity C.F.M.	Overall Dimensions—Inches			Unit Weight—Lbs.
		L.	W.	H.	
75	750	48	30	78	1600
150	1500	62	32	78	2000
350	3500	94½	42	82	3500
500	5000	107½	49	84	4800

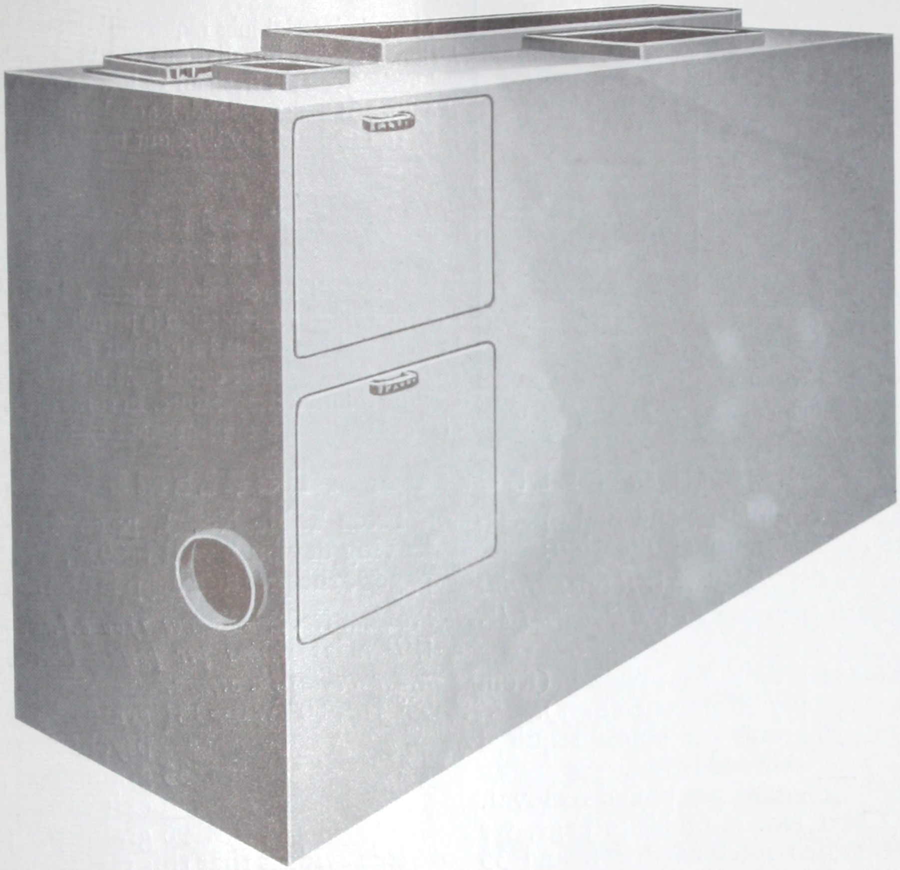
SC Kathabar • A PRODUCT OF

SURFACE COMBUSTION • TOLEDO, OH

Form No. K-42-4

Printed in U.S.A.

SPECIFICATIONS AND ENGINEERING DATA



The Kathabar System dehumidifies, or humidifies, in accordance with the need to maintain the desired percentage of air moisture. *Unlike any other principle*, Kathabar performs this dual function of *balancing* air moisture as a single automatic operation, independent of air temperature. Bypassing, precooling, reheating, after-cooling, or other complicated operations are generally eliminated. Operation is simple—results are accurate. The principle is proven in years of commercial application.

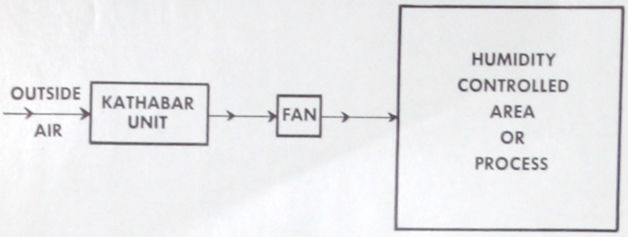
Typical applications include drug preparation and storage, gelatin capsulation, bottle drying, candy dipping, electrical insulation storage, photographic film manufacture and storage, lens grinding, multicolor lithography and printing, rayon and silk storage, abrasive manufacture, grain storage, plastics manufacture, food dehydration and storage, explosives manufacture, cupola and crucible dry blast, sugar storage, steel storage, paint and "dope" manufacture, hygroscopic chemical manufacture and storage, rubber and synthetic rubber manufacture, or any other industrial process where controlled humidity is essential to manufacturing or to maintaining product quality.

Kathabar systems are equally effective for comfort applications where *Chill*, *Shock* and *Clamminess* are objectionable.

GENERAL SPECIFICATIONS

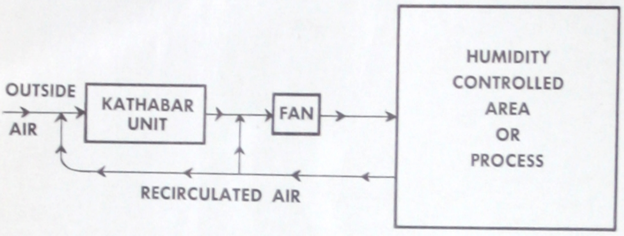
Model No.	Capacity c.f.m.	Overall Dimensions In Inches L.	W.	H.	Unit Weight
75	750	48	30	78	1600
150	1500	62	30	78	2000
350	3500	$94\frac{1}{2}$	42	82	3500
500	5000	$107\frac{1}{2}$	49	84	4800

TYPICAL APPLICATIONS



All Fresh Air

Many industrial jobs require all outside air with no recirculation. Comfort installations can usually be accomplished by dehumidifying the fresh air to low enough humidity to absorb the internal moisture load. Kathabar dehumidifies the air from high to low humidity without mechanical complications.



Fresh and Recirculated Air or All Recirculated Air

For industrial processing where a low exit moisture is desired and where recirculation is permissible. A constant amount of fresh and recirculated air is put through the Kathabar unit and the desired outlet conditions are obtained by simply controlling solution temperature. In some cases 100% recirculated air is used through the Kathabar system.

SAMPLE SELECTION PROBLEMS

Problem No. 1—Select equipment and find operating requirements for following application:

Reduce 1500 c.f.m. from 95° DB, 77° WB to 35 grains per pound leaving condition. 75° F. water and 25 lb. steam available.

95° DB, 77° WB = 111 grains per pound (from psychrometric chart).
35 grains per pound required exit condition.
76 grains per pound removal.

By referring to Chart No. 1, opposite page, we see that, at 111 grains inlet condition and 35 grains exit condition, we can easily obtain the desired conditions with 75° F. cooling water. We also see that the required removal of 76 grains is within the maximum possible of a unit of 100% rating. Therefore, we know that Model No. 150 will handle the load.

1500 c.f.m. = 112.5 lbs. air per minute.

$\frac{112.5 \times 76 \times 60}{7000} = 73.3$ lbs. water removed per hour from air.

Referring to Table No. 1, page 4, at 35 grain exit air and 75° F. water, the water consumption will be .226 g.p.m. per pound of water removed per hour.

Then, .226 x 73.3 = 16.6 g.p.m. water required.

From Table No. 2A, page 4, the amount of 25 lb. steam required is 3.1 lbs. per pound of water removed per hour.

Then, 3.1 x 73.3 = 227 lbs. steam required.

Also, from Table No. 2, page 4, we see that the resistance to air flow is 1.9 inches, and that 400 c.f.m. of waste air will be used through the regeneration cycle.

From Table No. 3, page 5, the approximate leaving dry bulb will be 92°. From Table No. 5, page 5, the pressure drop is about 6 lbs. per sq. in.

Problem No. 2—*Reduce 1500 c.f.m. from 95° DB, 80° WB to 35 grains per pound leaving condition. 70° water and 25 lb. steam.*

95° DB, 80° WB = 131 grains per pound (from psychrometric chart).
35 grains per pound required exit conditions.
96 grains per pound removal.

It is evident that this removal is more than the 80 grains maximum possible with any unit operating at 100% rating. Therefore, it is necessary to select the next size larger model, or, in this case, Number 350.

$\frac{1500}{3500} = 42.8\%$ use (50% rating curve, Chart No. 2)

Chart No. 2, opposite page, shows that, for inlet air of 131 grains, we can easily get 35 grain exit air or lower with water at 70° F. available. The Model No. 350 will then be satisfactory:

1500 c.f.m. = 112.5 lbs. air per minute.

$\frac{112.5 \times 96 \times 60}{7000} = 92.5$ lbs. water removed from air per hour.

Water consumption = 92.5 x .185 = 17.1 g.p.m. (from Table No. 1, page 4).

Steam consumption = 92.5 x 3.1 = 287 lbs. per hour (from Table No. 2A, page 4).

Resistance to air flow = .6 inches WG (from Table No. 2, page 4).

Leaving Dry Bulb = 91° (From Table No. 3, page 5).

Pressure Drop = 3 lbs. per sq. in. (from Table No. 5, page 5).

CHART No. 1

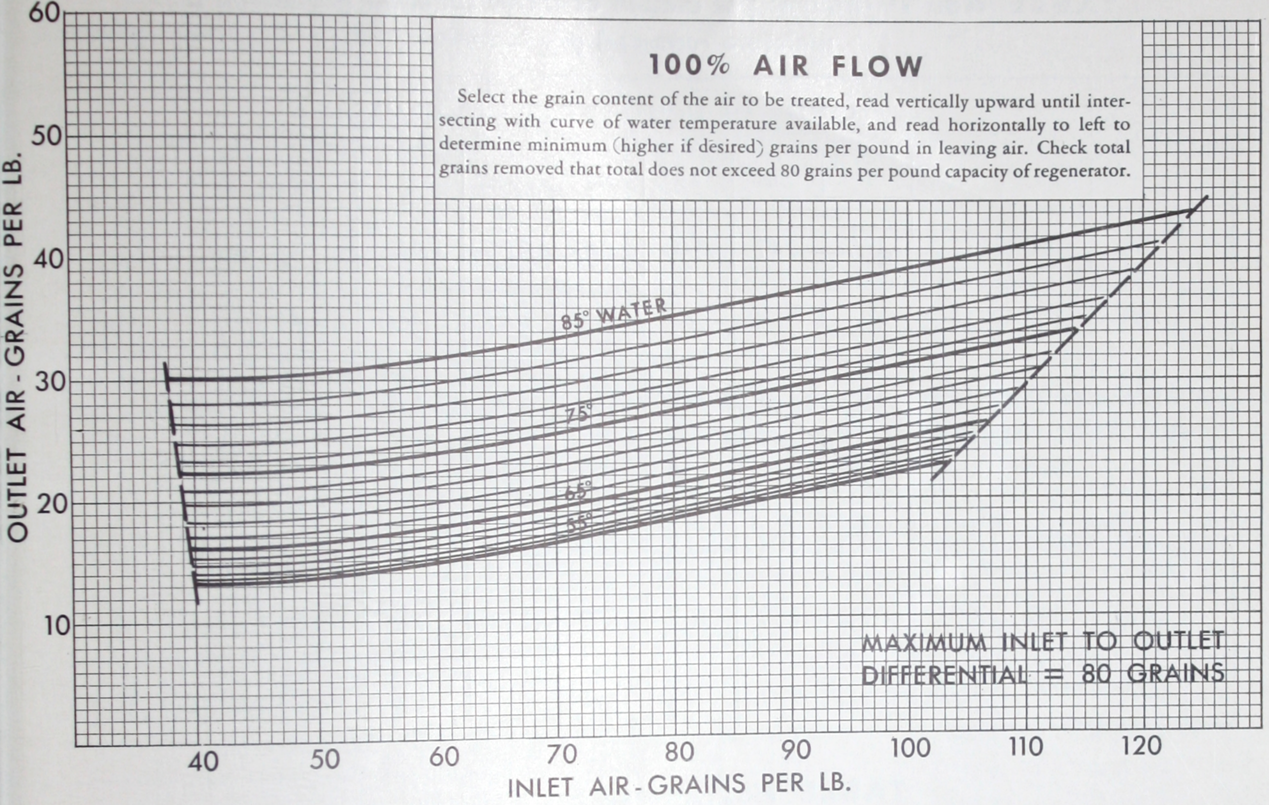


CHART No. 2

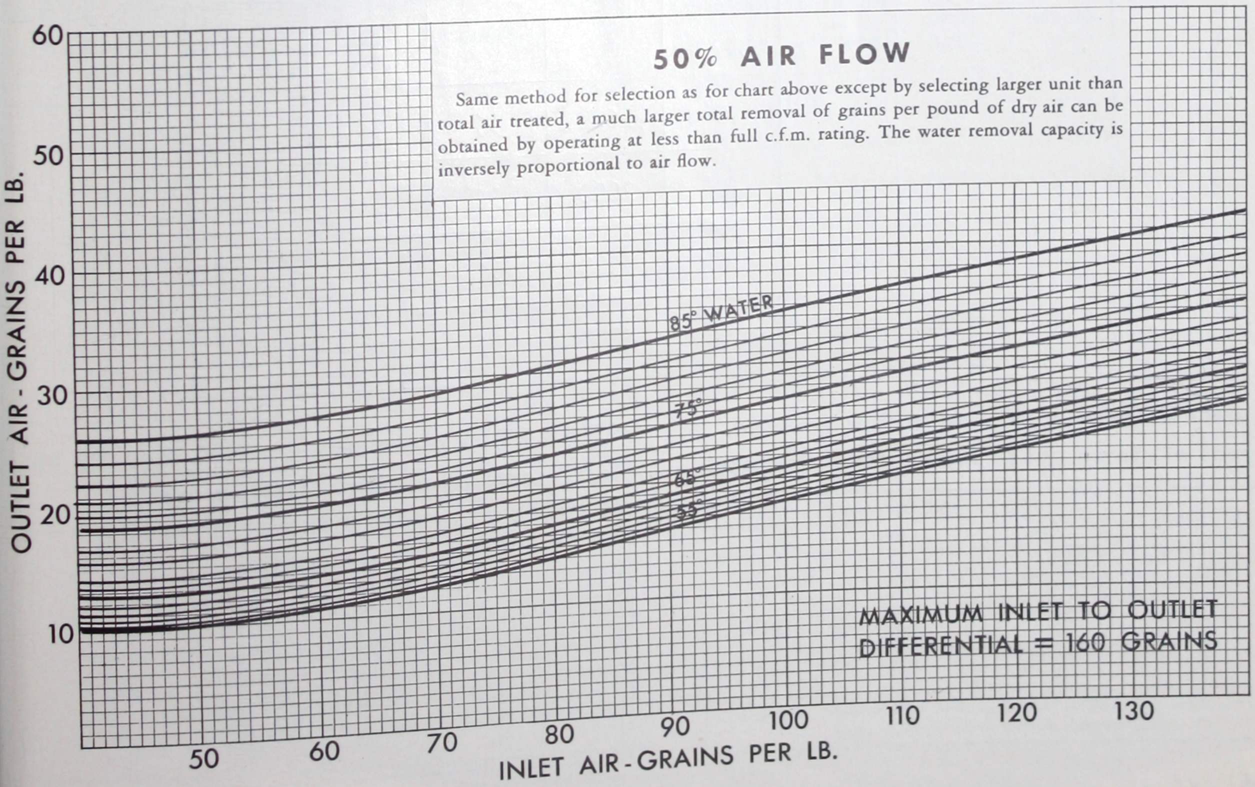


TABLE No. 1—Gallons per minute of water required per pound of moisture removed per hour

WATER TEMPERATURE	OUTLET AIR MOISTURE CONTENT—GRAINS/LB.										
	65	60	55	50	45	40	35	30	25	20	15
85	.110	.125	.167	.247	.340	.490	.785	1.15			
80	.108	.115	.135	.165	.205	.263	.352	.500	1.05		
75	.103	.110	.115	.132	.140	.160	.226	.370	.801		
70	.095	.098	.106	.110	.125	.147	.185	.240	.325	.485	
65	.094	.096	.097	.104	.111	.125	.147	.175	.218	.290	.425
60	.092	.093	.095	.097	.105	.117	.135	.160	.193	.240	.325
55	.090	.091	.092	.093	.094	.111	.117	.140	.177	.225	.300

TABLE No. 2—Unit Specifications

Model No.	Max. CFM	Resistance at 100% Flow	Resistance at 50% Flow	Unit Wt.	Reg. Fan HP	Pump HP	Reg. Air CFM
75	750	1.9″	.6″	1600	1/6	1/4	200
150	1500	1.9″	.6″	2000	1/6	1/2	400
350	3500	1.9″	.6″	3500	1/3	3/4	950
500	5000	1.9″	.6″	4800	1/2	1 1/2	1350

TABLE 2A—Maximum steam demand. Pounds of steam per pound of water removed.

Exit Grains	STEAM PRESSURE		
	5 lbs.	15 lbs.	25 lbs.
60	3.4	2.9	2.7
40	3.7	3.2	3.0
20	3.9	3.5	3.2

Total steam consumption is proportional to moisture removed. Average is approximately one-half the maximum required.

TABLE 2B—Water removal capacity of unit at various steam pressures

5 lb. — 65%
10 lb. — 85%
15 lb. — 93%
20 lb. — 96%
25 lb. — 100%

TABLE No. 3—Temperature of air leaving Kathabar unit—95° F. inlet temperature

INLET GRAINS	WATER TEMPERATURE 85	80	75	70	65	60	55
130	99	96	94	91	88	86	83
120	98	96	93	90	88	85	82
110	97	95	92	89	87	84	81
100	97	94	92	89	86	83	80
90	96	94	91	88	85	82	79
80	96	93	90	87	84	81	78
70	95	93	90	86	83	80	77
60	95	92	89	86	82	79	76
50	94	91	88	85	82	78	75

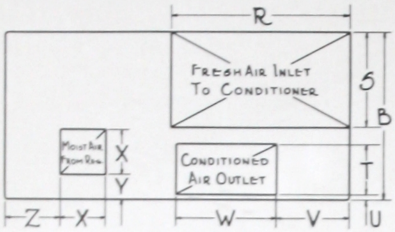
TABLE No. 4—Temperature of air leaving Kathabar unit—85° F. inlet temperature

INLET GRAINS	WATER TEMPERATURE 85	80	75	70	65	60	55
130	93	92	90	87	84	81	78
120	93	91	89	86	83	80	77
110	92	91	89	86	83	80	77
100	92	90	88	85	82	79	76
90	91	90	87	84	81	78	75
80	91	90	87	84	81	78	74
70	91	89	86	83	80	77	73
60	90	88	86	83	79	76	73
50	90	88	85	82	79	76	72

TABLE No. 5—WATER PRESSURE DROP, POUNDS PER SQ. IN. THROUGH CONTACTOR

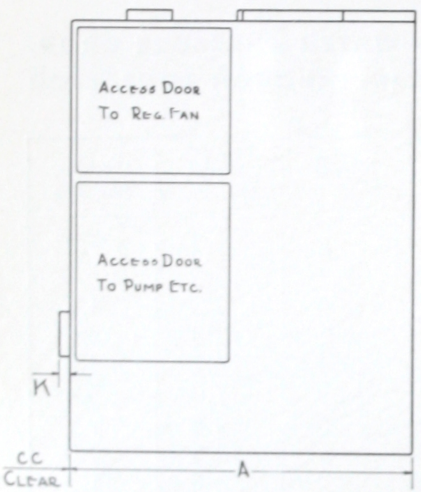
G. P. M. Water	Model No. 75	Model No. 150	Model No. 350	Model No. 500
5	.7	.6	.2	.2
10	2.8	2.3	.9	.8
15	6.4	5.6	2.0	1.6
20	11.5	9.2	3.4	2.6
25		14.3	5.2	3.8
30		20.8	7.0	5.4
35		27.6	9.6	7.1
40		36.1	12.5	9.0
45			15.6	11.2
50			19.1	13.4
55			22.8	16.1
60			27.2	18.8
65			31.6	21.8
70			37.0	24.6
75			41.5	27.8
80			47.4	31.2
85				35.0
90				39.0
95				43.0
100				47.0

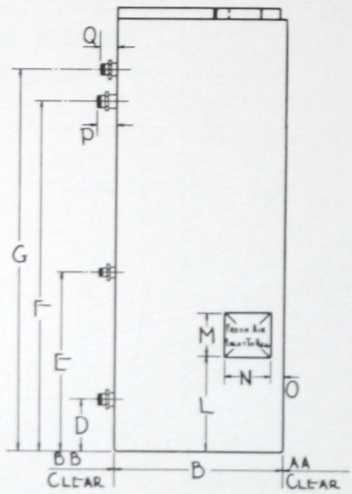
ROUGHING-IN DIMENSIONS IN INCHES—MODELS 75 AND 150

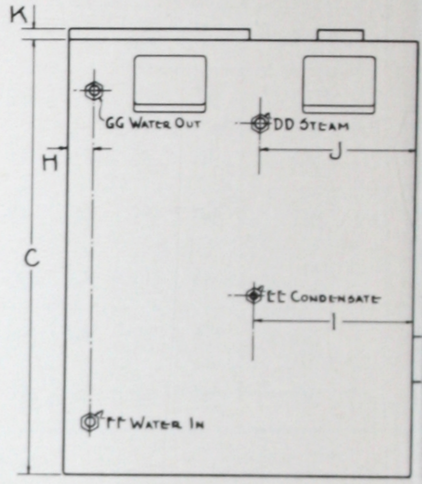


Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
75	48	30	78	9½	32½	63	68½	4	26½	26	2	17	8	8	2¼
150	62	30	78	9½	32½	63	68½	4¼	28½	28	2	17	8	8	2¼

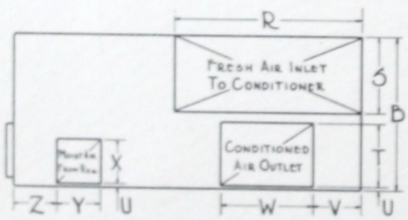
Model	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG
75	3⅛	3	20	15	12	1	12	7	8	4½	10	24	18	14	1½	1	1¼	1¼
150	3⅛	3	32	17	9	1	13	18	8	4½	10	24	18	14	1½	1	1¼	1¼





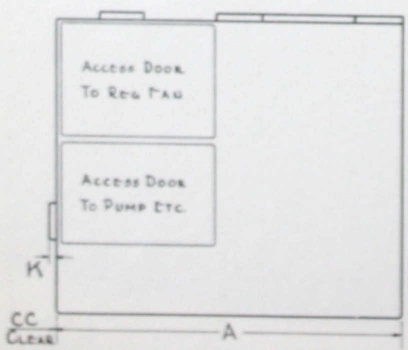


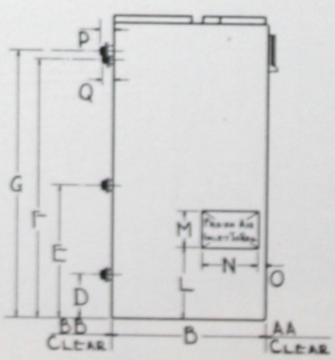
ROUGHING-IN DIMENSIONS IN INCHES—MODELS 350 AND 500

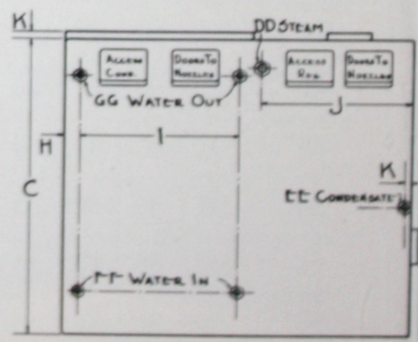


Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
350	94½	42	82	12¼	36	71¾	74	4¼	43	41½	2	20	10	15	2¼	3¼
500	107½	49	84	12¼	38	75¾	76	4⅝	52	44	2	22	12	18	2¼	3⅜

Model	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG
350	3⅛	51	21	17	1	13	25	12	12	11½	24	18	14	2	1½	1½	1½
500	3¼	61	25	20	1	13	35	13	13	17½	24	18	14	2½	2	2	2







GENERAL DESCRIPTION

Kathabar package systems are furnished as complete units, ready for setting in place and to be connected to duct system, steam, water and electricity. All connections are provided externally for quick and easy installation.

Inlet air comes in contact with the diffuser to provide an even distribution of air to the contactor-cooler. The contactor is of steel construction—¾″ tubing .020 fins with welded header. The Kathene nozzles, providing solution spray, are of wide-angle, large-orifice, self-cleaning type.

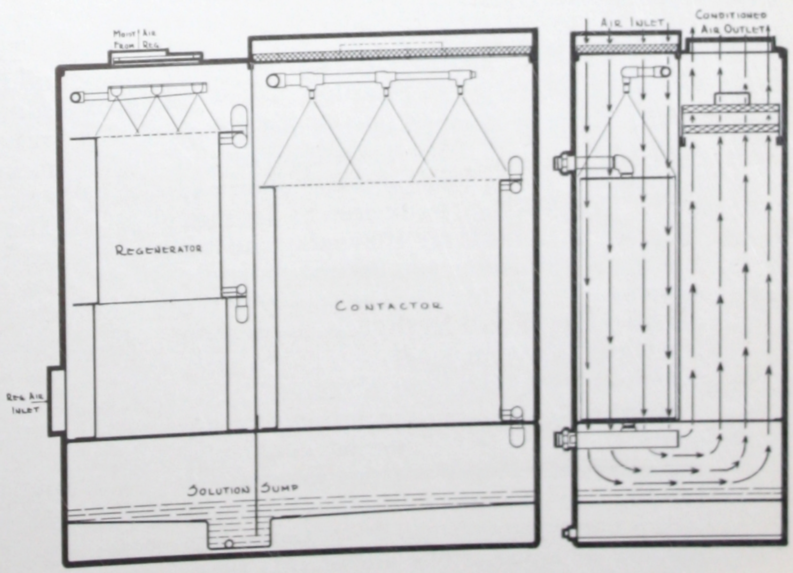
The regenerator part of the unit is of similar, trouble-free construction. The excess moisture or waste air fan is of formed steel and directly connected to a standard open motor, fractional horsepower, 60 cycle. Totally enclosed, direct current and 25 cycle motors available at extra cost. Refer to factory.

The Kathene solution pump is furnished with a self-priming device. It is directly connected with a standard fractional horsepower, 60 cycle open motor. Totally enclosed, direct current and 25 cycle motors available at extra cost. Refer to factory.

The two electric motors, the pump and the waste air fan are the only mechanical parts. These parts are easily accessible through doors in casing side. Motor leads terminate in standard junction box on side of the unit. Unit furnished with float type density control for connection through external circuit to automatic steam valve.

All internal piping is complete. Galvanized pipe and fittings used throughout. Hydrometer well is furnished to check density. Hydrometer and thermometer included with unit as well as insertion thermometers and pressure gauges in Kathene lines.

Auxiliary equipment, quoted separately, includes water control valve, steam control valve, starters for motors, external fan for handling conditioned air and external filters for total air supply.



Kathabar HUMIDITY CONTROL SYSTEM • *Package Series*

PRINCIPLE OF CONTROL AND OPERATION

1. General Principle of Control

The moisture content of air leaving the Kathabar unit is regulated by the temperature of the Kathene solution. At a constant density, the Kathene solution will remove water in an amount proportional to its temperature. Accordingly, in order to produce air at a given degree of dryness, it is only necessary to hold the density of the solution constant and to hold the Kathene temperature at the required degree to extract the moisture.

The density is held constant by cycling a steam valve in the regenerator coil line. When the Kathene solution picks up moisture from the air it consequently increases in volume and decreases in density. An integral float switch (supplied as a part of each unit) will rise on increase of float level and cause an electric circuit to be made. This circuit can then be applied through a relay to open the steam valve, and since the regenerator fan runs continuously, regeneration will start. When the Kathene has been regenerated to the proper density, the float switch will "break" and the steam valve will close and stay closed until the next cycle.

The temperature of the Kathene is held at the desired point by means of a modulating valve on the water line to the contactor. The valve can either be self-contained, regulated by an immersion thermostat in the Kathene line, or regulated by an external controller in the leaving air stream, depending upon the particular requirements of the application.

2. Typicial Control Methods

A. Constant Solution Temperature.

The Kathene temperature is held constant at a given value regardless of the magnitude of the load imposed upon the unit. The Kathene temperature is such that, at full load on the unit, the air emerging will be at the desired moisture content. At any load less than 100% the air off the unit will be slightly dryer than the required design conditions necessitate, which in most cases is an advantage.

In general, constant solution temperature control is suitable for comfort conditioning and process work where a lowering in leaving air dryness from the Kathabar unit is not of importance. By far the largest number of applications are of this type.

Constant solution temperature controls required for different systems are as follows. These are combinations of controls, any one of which will give the required regulation and any *one* combination can be used.

a. Self-acting modulating valve on water.
Electric two-position valve on steam.

b. Electric modulating valve on water.
Electric modulating immersion thermostat to control water valve.
Electric two-position valve on steam.

c. Pneumatic modulating valve on water.
Pneumatic modulating immersion thermostat to control water valve.
Pneumatic two-position valve on steam.
Electro-pneumatic switch to control steam valve.

B. Variable Solution Temperature.

The Kathene temperature is varied over a range with varying loads so that, regardless of the load imposed on the Kathabar unit, the air emerging will always be at a constant condition of moisture.

In general, variable solution temperature is suitable for process and industrial applications where an absolutely constant condition of moisture must be maintained and where any fluctuation would prove detrimental.

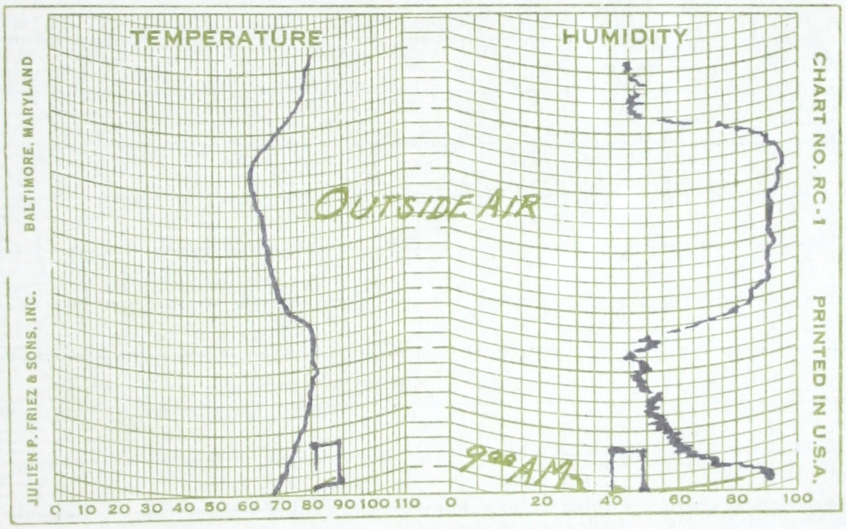
The controls required for this type of solution temperature regulation usually consists of the basic steam and water valves outlined in "A" plus an external means of controlling the water valve to arrive at the desired leaving condition. The scheme most frequently used necessitates a humidistat or wet bulb controller for actuation of the water valve. In addition, means must be provided to hold the leaving dry bulb constant, usually through an after-heating coil and dry bulb thermostat. Furthermore, external humidification might also be required.

Since almost every process represents a different control problem, it is not possible to list a representative scheme. If such a control scheme is required, refer to a factory representative.

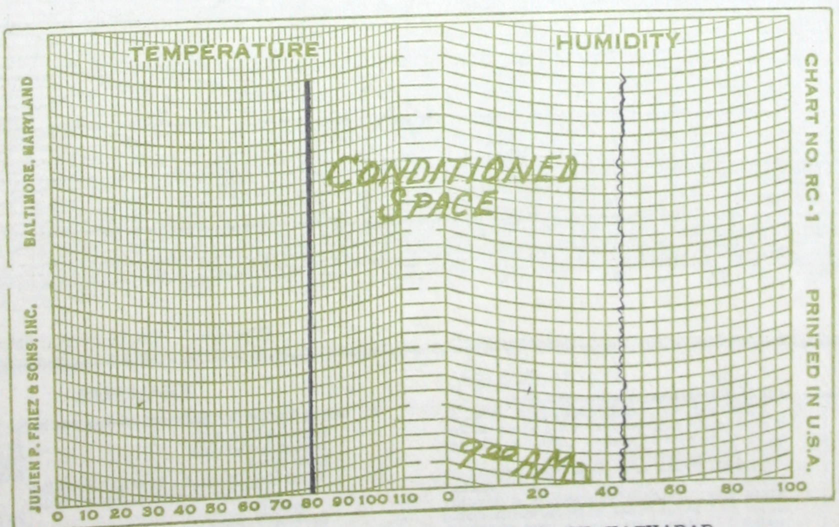
Kathabar **. . . a product of SURFACE COMBUSTION · TOLEDO, OHIO**

KATHABAR PERFORMANCE

Kathabar systems deliver the conditions you select directly without reheating or by-passing of the air. The ratio of latent heat to sensible heat may change radically within short intervals of time, yet the Kathabar system will add or substract moisture automatically and reliably to maintain the desired results.



AIR OUTSIDE CONDITIONED SPACE

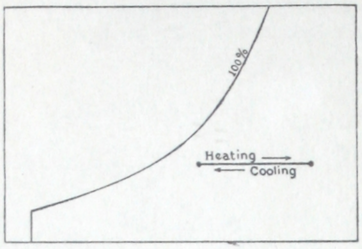


AIR INSIDE SPACE CONDITIONED BY KATHABAR

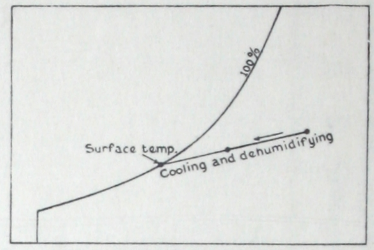
KATHABAR SURFACE COMBUSTION CORPORATION • TOLEDO, OHIO

A NEW HIGH STANDARD IN AIR CONDITIONING

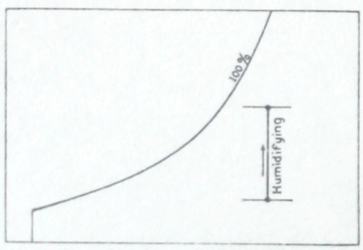
PSYCHROMETRIC CHART
AIR CONDITIONING PROCESSES



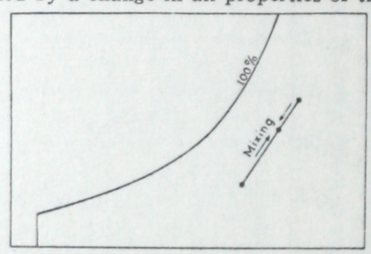
SENSIBLE HEATING AND COOLING of air is represented on the psychrometric chart by a straight horizontal line between the dry-bulb temperature limits of the process. These processes are distinguished by a change in dry-bulb temperature, relative humidity, wet-bulb temperature, total heat, specific volume, and by no change in moisture content, dew-point temperature, and vapor pressure of the air.



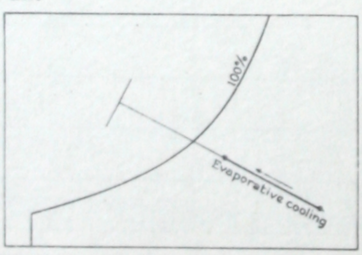
COOLING AND DEHUMIDIFYING of air is represented on the psychrometric chart by a straight line drawn between the initial condition of the air and the point on the 100 per cent line corresponding to the temperature of the cooling surface. This applies only when the surface temperature is below the initial dew point. The final condition of the air will depend on the total heat extracted from the air. This process is distinguished by a change in all properties of the air.



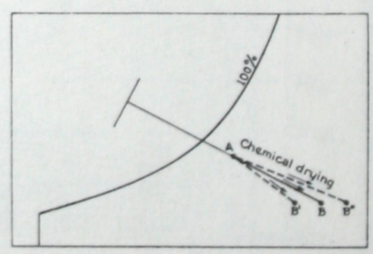
HUMIDIFYING of air, with no temperature changes, is represented by a straight vertical line along the dry-bulb temperature line of the air between the moisture content limits of the process. This process is distinguished by an increase in relative humidity, wet-bulb temperature, total heat, specific volume, moisture content, dew-point temperature and vapor pressure of the air.



MIXING of air at one condition with air at some other condition is represented by a straight line drawn between the points representing the two air conditions. The condition of the resultant mixture will fall on this line at a point determined by the relative weights of air being mixed.



EVAPORATIVE COOLING of air, by bringing it in contact with water at a temperature equal to the wet-bulb temperature of the air, is represented by a straight line drawn along the wet-bulb temperature line of the air between the limits of the process. In this process the total heat of the air remains unchanged because the sensible heat extracted from the air is returned as latent heat by an increase of moisture content. This process is distinguished by a change in dry-bulb temperature, relative humidity, specific volume, moisture content, dew-point temperature, vapor pressure, and by no change in wet-bulb temperature.



CHEMICAL DRYING of air is represented by a straight line along the wet-bulb temperature between the limits of the process (AB) only in case the drying is purely by adsorption (the drying agent does not dissolve in the water extracted from the air) and only in case the drying agent does not retain an appreciable amount of the heat of vaporization liberated when the water is condensed on the surface of the adsorber. In case an appreciable amount of this heat is retained by the adsorber, the process takes place on a line below the wet-bulb temperature (AB′). If the drying agent is soluble in water (such as calcium chloride) the drying process is above (AB″) or below (AB′) the wet-bulb temperature, depending on whether heat is liberated or absorbed when the agent is dissolved in water.